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Mr. Carnegie's Gift to his Employees.

Four million dollars of the money which Andrew Carnegie has declared it is his purpose to give away during the remainder of his life goes to what is we believe by far the most magnificent provision for superannuated or disabled employees and those dependent upon them that has ever been made. This is, we think, an especially commendable thing for Mr. Carnegie to do. It goes so much further and will be so much more useful than the fine words we sometimes hear about "faithful and loyal employees without whose help it would have been impossible to have built up this magnificent works" and all that.

We join in the general hope that his example will be followed by others who are fortunate enough to acquire more money in manufacturing operations than they or their families can possibly make personal use of. It is a credit to Mr. Carnegie that he should thus acknowledge in such a substantial manner the fact that his fortune is built primarily upon the fact that he has been able to command the services of skilled men and of thousands of others not so skilled. The fact that so many others who have become wealthy and have retired without showing any evidence of such appreciation is not considered disgraceful by the general public is only because it is so common.

At the same time we think it must be clear that such a provision as Mr. Carnegie has made for needy employees cannot in the nature of things become universal nor a general solution of the social and industrial questions of the day. If, for instance, it should, by the operation of public opinion or otherwise, become the rule that very wealthy manufacturers should thus provide for their men and their families, then workmen would, other things equal, all want to work for wealthy employers, and not for the poorer ones. This would give to the wealthier employers an advantage in the labor market which would have a distinct tendency to prevent the poorer employers from becoming less poor. In other words, it would tend to make the prosperous employers still more prosperous at the expense of their less prosperous competitors and in the end would inevitably come to be more or less an offset or a substitute for wages; exactly for the same reason that positions in the army and navy are now occupied by men who could earn higher salaries in private employment, but who stay in the government service because they know that they will be provided for as long as they live and their dependent families pensioned.

It is probably some sort of recognition of this principle that makes the German Government take a hand in these matters and require some provision to be made for disabled or superannuated employees. By thus managing the matter, the cost of doing it becomes an element of the cost of the goods produced which each manufacturer bears in proportion to the magnitude of his business, and thus no one manufacturer nor class of manufacturers derives special advantages from it.

It is very clear that this has a bearing on the wages for which men will work, or rather, upon the rate of wages which are fixed by the law of supply and demand. That is to say, it has its bearing upon the question often decided one way or the other by the individual as to whether he shall remain an agricultural laborer or go into a factory; or, whether he shall remain in Germany, where he will receive a benefit from this system or emigrate to America, where he will receive higher wages but will not have the benefit of such a system, and thus it reacts upon the rate of wages generally paid in industrial occupations.

In Germany every employer of a house maid has to buy and place in her book every week a stamp; the money so received being again expended by the government in caring for those house servants who become sick or otherwise disabled. There can be no doubt that if this system were done away with, a sufficient number of girls would go into other employment or emigrate to America to enable those who remained to get higher wages, and this shows how it is that in the end and in the long run the cost of all such things comes out of the producers themselves.

Of course, this does not detract in the least from the creditable nature of Mr. Carnegie's gift, nor do we mean to intimate that it does do so; but the fact is that the vast majority of manufacturers, especially those who are not able to take advantage of any kind of monopoly but who do business in strictly open competition never become able to do magnificent things for their employees, and we think if they all did become able and did so, the results would be no better in the end and probably not as good as they would be if the interest of the employer were shown in the form of securing the best possible working and social conditions and in paying the highest possible wages as he goes along. Pensions and the like are not ambition-inspiring things—they only tend to make unambitious men "hang on to their jobs" until the time for retirement comes. The poorest servant girl in Germany who can manage to hold her place gets just as many stamps in her book as the best servant girl that can be found there.

The Carnegie Technical Institute.

Some weeks ago a report was current, and well founded, we believe, that Mr. Carnegie contemplated the establishment in Pittsburgh of a great technical school of some kind, and more recently the report has gained circulation that the sum to be given for the purpose is twenty-five million dollars.

The report lacks adequate confirmation, and, in view of these figures, we may well hesitate to believe it until it is confirmed. Such a sum would dwarf even Mr. Carnegie's previous benefactions, but we may say that we have no doubt whatever that even this amount of money, and, for that matter, a still larger amount can be well and wisely expended in the furtherance of technical education in this country. We should, however, be very sorry to see it used for the endowment of schools which would substantially duplicate the work of those now in existence. We are not pre-

pared to say that we have enough schools of the existing type, but we are prepared to say that the existing type should not be increased in point of numbers until other schools of which we have few or none have received the attention they deserve. Our readers are aware of our sympathy with the plans of Professor Higgins, and our own ideas on schools for the making of engineers from mechanics rather than from high-school boys have been fully published in these columns. These two ideas are, in fact, mutually supplementary, and we believe that in them lies the possibility for the establishment of a school which would be of incalculable advantage to the industries of the country and to boys for whose education very little has been done. Considering Mr. Carnegie's antecedents and his often-expressed sympathy for those who are circumstanced very much as he was in boyhood, it would seem as though such plans, or others of similar purpose, would be peculiarly attractive to him. We certainly hope that his magnificent generosity will be the means of doing a work for which there is crying need and not of duplicating what is, on the whole, very well done already.

The Belleville Boiler in the British Navy.

According to press cablegrams, the recently issued British Admiralty Report condemns the Belleville boiler for naval purposes and says:

"The advantages of water-tube boilers for naval purposes are so great, chiefly from a military point of view, that, provided a satisfactory type of water-tube boiler could be adopted, they would be more suitable for the navy than the cylindrical boiler. The committee does not consider that the Belleville boiler has any such advantage as to lead it to recommend it as the best adapted to the requirements of the navy. It recommends, as regards the ships to be ordered, that the Belleville boilers be not fitted in any case, and that in the ships under construction Belleville boilers be not used if work on the boilers is not far advanced. Where a change of boilers would delay the completion of the ships, Belleville boilers should be retained, and they should also be retained in completed vessels."

To quote further from the press despatches, among the objections to the Belleville boilers are the following: "The circulation of the water is defective and uncertain; the automatic feeding apparatus is of a delicate and complicated kind; there is a great excess of pressure required in the case of the feed pipes and the pumps over the boiler pressure; the amount of coal consumed is relatively greater in the Belleville, involving greater cost; there is an excess of boiler pressure over the working pressure of the engines, the water gages do not indicate with certainty the amount of water in the boiler."

Some of the alleged objections seem reasonable enough, but others we are unable to understand. Why, for instance, should there be a greater excess of pressure in feed pipes and pumps with Belleville boilers than with any other? or why should there be a greater difference between boiler and initial or steam-chest pressure with Belleville boilers than with any other? The British technical journals, when they arrive, will probably throw some light on these interesting problems.

The Proposed Philippine Tariff.

A customs tariff for ports in the Philippine Archipelago has been recommended by the commission appointed for the purpose. Below are given the proposed rates of duty on a number of kinds of machinery and related articles. It is important for manufacturers to see them at this time because the War Department will be pleased to receive recommendations and suggestions up to April 15, and after the Russian experience it is likely that machinery builders will be disposed to take a more than formerly outspoken interest in tariff tinkering. It is to be noted, however, that the impending decision of the Supreme Court on the question whether our Constitution extends over all the territory claimed by the nation may summarily wipe out the entire matter. If the Philippines are a part of the United States within the meaning of that instrument, not a penny of duty can be collected from trade between those islands and ourselves on either side and the Philippine tariff against other nations will be the same as that of this country; nor can different arrangements be made without either an amendment or a setting aside of the Constitution.

In the following list it is to be noted that gross weight includes all coverings without allowance for tare, and net weight is the weight of the articles exclusive of covering. The duties are expressed per 100 kilogrammes (220½ pounds) except where otherwise stated:

Agricultural apparatus and machinery, 25c. per 100 kilos., gross weight; agricultural tools and implements, $1.50 per 100 kilos., net weight; air motors of all kinds, $1.50 net; leather belting, $1.00 net; bench lathes, $1.00 net; boilers for engines: Sheet iron, 50c. gross; other, 75c. gross; hydraulic cranes, 30c. gross; cranks of wrought iron or steel, $1.05 gross; dredging machinery and apparatus, 25c. gross; dynamos, $5.00 net; marine engines, $1.50 net; traction engines, $1.00 gross; galvanometers, $25 net; gas motors, $1.50 net; hoisting, road-making and pile-driving machinery, 25c. gross; hydraulic cranes, 30c. gross; ice machinery, 25c. gross; inductors, $3.00 net; cast-iron lubricating boxes, 30c. gross; iron or steel cables, 75c. gross; machinery for repairing foreign vessels, free; steam pumps, $1.50 net; railway axles, straight, wrought iron or steel, 45c. gross; railway carriages, $100.00 each; locomotives and tenders, $1.00 per 100 kilos.; railway switches, 50c. per 100 kilos. gross; machinery and apparatus for weighing goods in bulk, 50c. net; platform scales and weights, and counter scales having platforms, and steelyards and detached parts of same, $3.00 net; balance and spring scales, with weights and scoops, 25c. per kilo. net.

The National Bureau of Standards.

The act for the establishment of the Standardization Bureau provides that the functions of the bureau shall consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus; the solution of the problems which may arise in connection with standards; the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be secured of sufficient accuracy elsewhere. The functions of the bureau are to be exercised for any society or person within the United States engaged in pursuits requiring the use of standards or standard measuring instruments. For such services, except those performed for the Federal or State Governments, a reasonable fee will be charged. The bureau is to be under the supervision of a visiting committee of five, appointed by the Secretary of the Treasury, and serving without compensation other than actual expenses.

A. F. Tennille.

Two patents, assigned to the General Electric Company, have recently been issued for different devices for producing end play in rapidly rotating shafts. All experienced mechanics know how valuable is a little longitudinal movement of a shaft in promoting its proper lubrication. One of the patents referred to also assigns another function to the device as for maintaining uniform wear on commutators or collectors. It is a hint worth noting that such devices are considered of such practical importance.

It seems to be the fashion now to double the maximum tonnage of the transatlantic steamer every ten years. In 1881 the largest steamer was the "City of Berlin," of 5,526 tons; in 1891 it was the "City of Paris," 10,499 tons; in 1901 a new White Star steamer of over 20,000 tons will be completed. Shall we have the 40,000 tons in 1911?

Commercial Review.

NEW YORK, Monday, March 18.

THE ENGINE MARKET AND OTHER LINES.

If the market for machine tools is the most interesting to the average reader of this paper from his own immediate standpoint, the engine trade is a pre-eminently important one, since it reflects business conditions throughout the country, both in manufacturing lines and in electrical enterprises, the successful launching of which is dependent upon the amount of capital seeking investment. On this ground the outlook as far ahead as one can see is radiant for manufacturers generally, including those of machine tools. Engine sellers in town with a satisfactory degree of unison witness activity of demand and inquiry, and much opinion is to the effect that 1901 is running better than the corresponding portion of 1900. One of the principal engine offices in the city has noticed especially a number of large enterprises which have gradually been approaching the point where they will be closed up. Street railway work is prominent among them. The way some of the builders of Corliss engines talk of the pressure of work and the difficulty of getting early deliveries reminds one of 1889. The lengths of time required for delivery vary greatly. While one concern names 8½ months or over for an 800 horse-power engine and another is still more cramped, four or five months is more nearly representative of average conditions.

The exceptions to the buoyancy in the engine market that we have noticed are rather in the smaller lines than in the Corliss type. There is some complaint, for instance, at the demand for high-speed electrical work in New York city.

A movement is said to be on foot to consolidate a large number of makers who were not included in the International Steam Pump Company.

The Bass Foundry and Machine Works have closed a contract for an 800-1,000 horse-power cross-compound condensing engine, three boilers, stack, condenser and heater for a 42-mile electric railway at Oneonta, N. Y. The engine will be direct-connected to an electric generator from the General Electric Company.

A steady, active market is reported by the A. D. Granger Company, 95-97 Liberty street, New York (also Stephen Girard Building, Philadelphia), which has succeeded the firm Burhorn & Granger. The company represents exclusively in New York and Philadelphia territory the Stearns Manufacturing Company, Union Iron Works and Skinner Engine Company, all of Erie, Pa., and the American Fire Engine Company, of Seneca Falls, N. Y. The Skinner Engine Company is just completing machine-shop and foundry enlargements which will increase its capacity about 25 per cent.

The Harrisburg Foundry and Machine Company is filling an engine order amounting to about 1,000 horse-power for a smelting works at Monterey, Mex. The General Electric Company will furnish the electric-generating portion of the equipment.

Monterey, Mex., is at present the storm center of a movement promoted by Enrique Creel, of Chihuahua, and abetted by Charles R. Flint, of New York, which has for its object the gathering of certain industries into pools. The 400 Mexican cotton mills are among the works referred to. An iron trust was proposed, but the syndicate which is erecting a $10,000,000 steel plant at Monterey spoiled that game by refusing to join in. The success of the American Smelting and Refining Company in acquiring the smelting and large mining interests of the country seems to have induced the new projects. With these up-to-date trusts Mexico must be an enlightened country.

We noticed last week the special announcements of the purchase of the Arcade File Works by the Nicholson File Company. Subsequently circulars have come announcing the transfer of the works of the Kearney & Foot Company. One is signed by this concern and states the fact of the sale of its business and works at Paterson, N. J., and Kent, O., to the Nicholson File Co. In the other the Nicholson company announces that it will continue the manufacture of the "K. & F." brand of files at the Paterson and Kent works; that all remittances and correspondence connected with the Kearney & Foot business should be addressed to the Nicholson File Company, Providence, R. I., and that a stock of the K. & F. files will continue to be carried at Nos. 100 and 102 Reade street, New York, for the convenience of parties in the vicinity who require the immediate filling of small orders.

At the annual meeting of William Jessop & Sons, Sheffield, England, March 12, it was announced that the directors will shortly establish works in the United States to carry on certain branches of their business. This action is compelled by the combination of crucible steel makers in America.

A rather interesting announcement is that made in England that two Sheffield firms are about to establish factories in Russia for the manufacture of files and high-grade steel tools.

It is reported that the workshops of the East Indian Railway and of the Bengal-Nagpore Railway will shortly be driven by electricity.

A commercial museum has been established at Belgrade, Servia, to receive samples and models of the best foreign products.

For a good many years there has been under discussion a project to utilize the power of the Rhone electrically. It now takes the form of a plan to derive over 20,000 horse-power for use in the city of Lyons or vicinity by digging a costly canal, which is under way.

The "Gewerbeverein für Hannover," a business union in Hannover, Germany, has had open for two years a permanent exhibition of machine and other tools. The machinery is put in motion electrically at certain hours on several days a week. An information and sales bureau is connected with the exhibition. The union reports that this show, in connection with a more general exhibition held there, was visited in the year from April 1, 1899, to April 1, 1900, by 23,855 persons. The sales of machine and other tools in that time amounted to 30,051 marks (about $7,500), which seems rather to the disparagement of this method of marketing machinery, so far as direct results are concerned.

Recent press advices from Germany report alarming declines in the iron market. From December 1, 1900, to March 1, 1901, puddling iron has fallen from 87 @ 90 marks per ton to 61 @ 65 marks. Bessemer in the same time has dropped from 90 @ 100 marks to 61 @ 63 marks, and No. 1 Foundry from 95 @ 100 marks to 63 @ 66 marks. The decline from July 1 to December 31 last was 40 per cent. on wrought iron bars, 35 per cent. on open-hearth steel and 23 per cent. on steel rails. Pig iron production decreased 25,000 tons in January output, as compared with that for December and the curtailment for February was still sharper, yet the stocks in consumers' hands have risen and are now estimated at 200,000 tons.

From a report of the German wire-nail syndicate, it appears that they have been selling at 326 marks to the German consumer and only 213 marks to the foreigner. This is like the tactics pursued by the American wire-nail trust that flourished about four years ago.

Not only in Germany but in Austria is there an agitation to increase the tariff against American iron and steel goods. This borrows pertinence from the fact that the expiration of our existing tariff treaties with Austria-Hungary in 1902 will necessitate a revision of the customs.

Consul Plumacher has sent from Maracaibo a copy of the Venezuelan tariff schedule, a new and revised edition of which has lately been published in that country. It appears on advance sheets of consular reports issued by the Bureau of Foreign Commerce, State Department, Washington, D. C.

CHICAGO MACHINERY MARKET.

The representative of one large machinery house at Chicago remarks that the only machine shops that within his observation are not doing an active business are those that are not well equipped with the best tools and are therefore not in a position to turn out the most speedy and economical work. There are only a few of these old-fashioned shops and they are retiring so rapidly to the background that they almost cease to count. They are

among the jobbing shops, for those connected with large manufactories are generally apace with improvements.

Other factors in the machine-tool trade note a condition slightly less favorable in the general situation. They say in effect that in the music of shop activities there is a minor note of hesitation, especially among the contracting or jobbing shops. It is not sufficiently assertive, however, to attract notice unless one is watching for unfavorable symptoms. The general character of buying just now is of the small-order variety. Users buy one or two tools, or a few, just as they happen to need them. The aggregate is satisfactorily large, but not of sufficient proportions to sound the tom-toms about. Trade since the first of the year has been running with rather remarkable uniformity, fairly good but not especially notable.

One of the few moderately large orders of the past month in shop tools was that of the Burlington road to re-equip the burned shops at Hannibal. It is said that from $30,000 to $35,000 worth of tools were bought and that the business was fairly distributed.

Slowly the Rock Island arsenal business is being placed. Within the past few days some of the bidders have been officially advised that their proposals have been accepted. The query arises in the minds of some of these machine-tool men whether after such a long interval a bid is yet alive. However, the business seems to be accepted, despite the period of waiting.

Hill, Clarke & Co. report an entirely satisfactory trade during the past month. While transactions have been mainly in small lots, a few good contracts have been placed, one of which was for $6,000 or $8,000 worth of tools for the repair shops of the Illinois Steel Company at South Chicago. Another was the outfit for the repair machine shop of a new smelting plant to be erected at Torreon, Mexico.

Rudolphi & Krummel say trade just now is running almost entirely to stock presses. At times their business consists mainly of special tools, but that kind of inquiry is slack and both large and small users are ordering machines of standard sizes so steadily that the aggregate is large.

Fraser & Chalmers are receiving a good demand for mining machines from all parts of the world, except South Africa. Their shops are running night and day. One recent contract is for a $125,000 smelting plant at Torreon, Mexico.

CINCINNATI REPORT.

Local interest in machinery affairs has, in a measure, veered around to the stationary engine builders, brought about through the publication, under a Pittsburgh date line, of an item affecting to show a consolidation among the manufacturers. Nothing is known of it in Cincinnati aside from the fact that some three years ago the Lane & Bodley Company was approached by one E. F. Park, who is accredited in the despatch of a day or so ago with having secured 80 per cent. of the country's concerns in a deal capitalized at $27,500,000.

President Lane's concern is not "in it." He does not believe the interests of any independent manufacturer will be subserved by consolidation and does not fear a "freeze out" for any outside concern, principally because of the vast diversity (both in character and sale of product) enjoyed in the conduct of the stationary engine business.

The Lane & Bodley Company has just sent out a letter to its agents, showing their domestic distribution of product—wider than any previous period's history of the concern—covering Delaware, New York, Ohio, Indiana, Kentucky, Texas, Louisiana, Mississippi, Georgia, the Carolinas, Florida, Alabama, and the entire Pacific coast. These were all Corliss types.

Business in South Africa, which in previous years offered much encouragement to the engine builders, is at a standstill. It is not time for inquiry from the cotton-seed oil mill and sugar-refining concerns, from all of which, considering ruling conditions, it is argued the future holds great promise for the builders of engines.

The Houston, Stanwood & Gamble Company, builder of stationary engines (other than the Corliss types) has been running twenty-four hours per day for the past two years. They are turning out two large engines for the Brookhaven Lumber Company, Brookhaven, Miss.; a number for a Jackson (Fla.) company, and have just shipped eighteen engines to the Allegheny Plate Glass Company—ten of them 125 horse-power and eight of 150 horse-power capacity.

I. & E. Greenwald report demand good for engines running to larger units, into which line the company has recently made a venture. Business has justified running two shifts for some time. An order from Arkansas calls for 250 horse-power for cotton-mill installation; one from Texas for 350 horse-power, and some good orders have come from the East.

The Cincinnati office of the Park Steel Company reports being six weeks behind on plate and bar, with market about stationary on better grades.

In regard to the discussion anent the Russian countervailing duty, it is safe to say that the representative machine-tool concerns are more seriously disturbed over commercial (machinery) relations with Canada than fear of the recently imposed Russian duty. One manufacturer said to the writer to-day that the principal trouble with the Canadian market was, and had been for some time, the big duty imposed on American products of this character taken across the border.

The retirement of Kasson, who occupied a responsible post in the government service in the negotiation of foreign treaties, is looked upon by the local machinery producing community as significant in the Russian connection. A few representative machine-tool manufacturers affect to believe that the solution of the whole thing rests with the Senate. "That is where our hope lies," said one. "If the sugar people do not unbend, I believe our cause is virtually hopeless."

As a rule, increasing inquiry is reported with all prominent concerns, and while this increase is daily assuming more formidable proportions, it is yet not of the satisfactory character of that of two years ago, which is rather universally regarded as "high-water mark."

The Bradford Machine Tool Company reports prospects brightening with inquiry increasing. The manufacturers of electrical machinery report favorable conditions in demand, principally for power equipment. The Triumph Electric Company has fitted out a complete steamboat plant and sent a duplicate of the machine sold about four months ago to the Laclede Gas Light Company, of St. Louis—a 200-kilowatt three-bearing belted type machine. Five motors of the direct-connecting type went to Benedict Bros., of Baltimore. The Bullock Electric Manufacturing Company reports conditions good on foreign business, confined largely to England and France.

Quotations.

NEW YORK, Monday, March 18.

Iron—Pennsylvania Pig, Jersey City delivery:

No. 1 X foundry	$16 50 @ $17 00
No. 2 X foundry	15 50 @ 16 00
No. 2 plain	15 00 @ 15 50
Gray forge	14 00 @ 14 50

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 75 @ 16 25
No. 2 foundry, or soft	15 25 @ 15 75
No. 3 foundry	14 75 @ 15 25
Foundry Forge, or No. 4	14 25 @ 14 75

Bar Iron—Base sizes—Refined brands, mill prices on dock, 1.50 @ 1.60c.; from store, 1.75 @ 1.90c.

Tool Steel—Base sizes—Standard quality, 7c.; extra grades, 10c. upward.

Machinery Steel—Base sizes—From store, 1.85 @ 2.50c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 3c.

Copper—Lake Superior ingot, 17c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c.

Pig Tin—25½ @ 25⅞c, for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½c. extra for carloads.

Spelter—3.92½ @ 3.95c., New York.

Antimony—For 5-cask quantities, Cookson's, 10⅜ @ 10½c.; Hallett's, 9c.; Japanese and Italian, 8.70c.

Lard Oil—Prime City, in barrel lots and over, about 65 @ 66c., according to quantity.

The Paris Exposition—XIX.

IMPROVED HOLLOW HEXAGON TURRET LATHE BY WARNER & SWASEY.

In our issue of March 30, 1899, we published an illustrated account of Warner & Swasey's hollow hexagon turret lathe. Since that time the machine has been considerably improved, and, as shown at Paris in its improved form, attracted a great deal of attention. In view of our previous illustration of the machine, it is probably not necessary to go over all the ground again, but it will be worth while to glance at some of the new features of it.

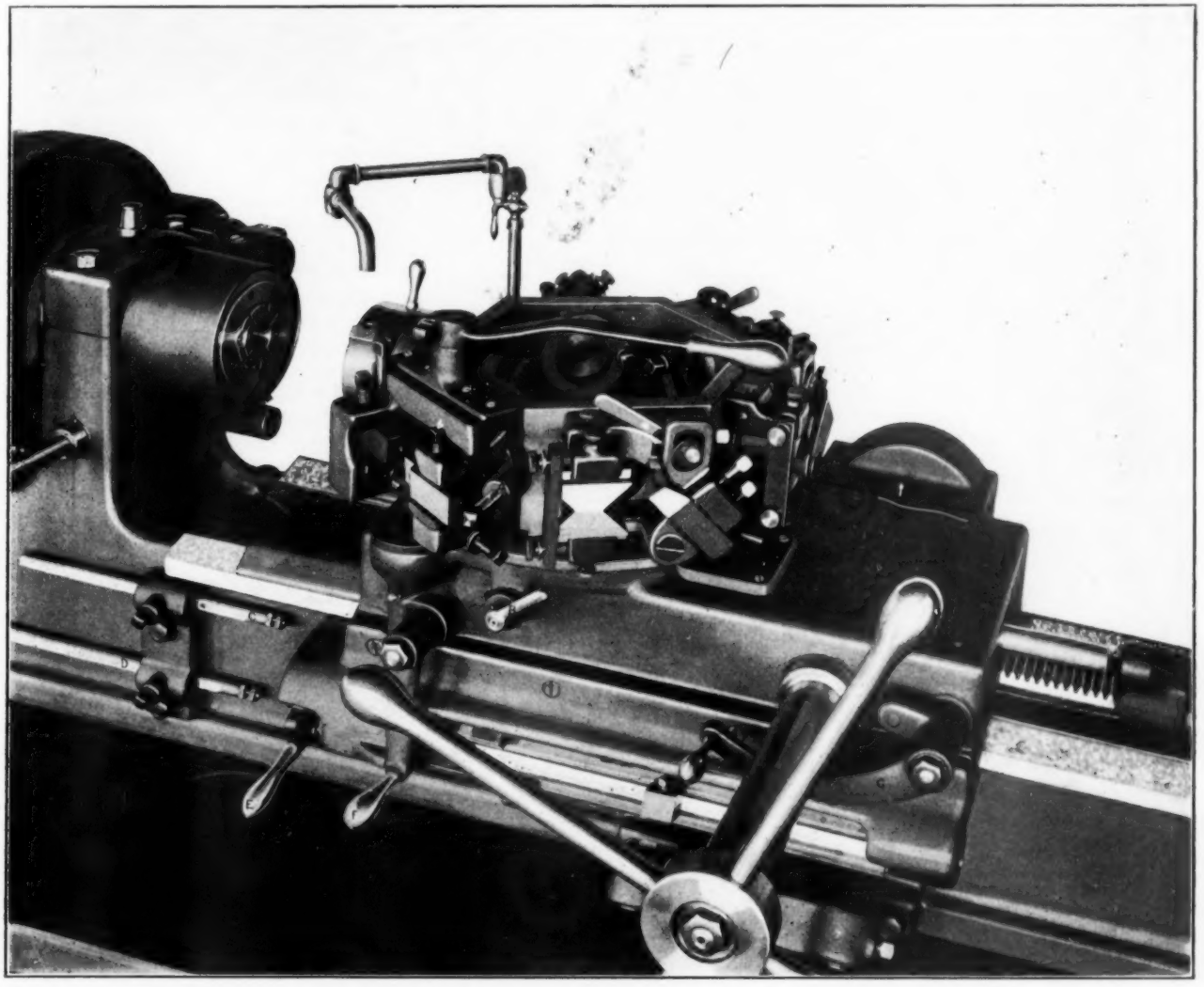


FIG. 165. VIEW OF TURRET OF HOLLOW HEXAGON TURRET LATHE SHOWN AT PARIS BY WARNER & SWASEY.

Fig. 165 is a view of the turret and showing at *A* the stock-stop, which is a special supplementary stop provided for gaging the length of the piece to be made, or the projection of the stock from the chuck, and consists of a screw which is tapped through the wall of the turret at one of its corners and an extra indexing point for the turret is provided to correspond. Thus, when the small lever *B* is placed in the position shown in the photograph this special indexing point is not operative, but the turret turns past it as though no such extra indexing point existed. But when this lever *B* is turned up to the vertical position this stop is operative; the turret automatically stops with the screw in line with the spindle and the stock is therefore gaged by a stop attached to the turret itself, which is entirely out of the way when not in use and leaves the six holes of the turret available for the various cutting tools. This special stock-stop takes the place of the one which was at first employed and which had to be swung in place whenever it was to be used.

Two extra turret stops have been added to the machine and these are shown at *C* and D. They are round bars which can be clamped at any desired projection and have screws in their ends which are used for the finer adjustments. These stops do not always or necessarily act when set but are made to act by means of the lever *E* so that by moving this lever at the right time two supplementary stops are provided for any one of the tools used in the turret. These extra stops are found especially useful for facing shoulders, as is sometimes done with the cut-off tool. The lever *F* clamps the turret when it has been rotated to position so that in case of an extra heavy cut or where specially accurate work is to be done the turret may be clamped rigidly, though it is not considered to be necessary for most work. The lever *G* throws in and releases the feed.

In the machine as now made the spring collet in the chuck is not changed for every different size of bar that is to be worked, but the one collet is adapted to receive and hold bushings, which of course are all alike outside and fit the spring collet, but are bored to suit the bar. This feature is shown in the photograph, Fig. 166, in which the collet is shown with one-half the bushing, *i. e.*, two pieces of it removed and the other in place. These bushings are readily inserted or removed by the fingers without taking the collet from its place. They are prevented from being forced outwards by the shoulder *X*, they engage at the rear and are driven by the tongue *Y* and dovetail *Z*, while the catch *U* holds them in place, this catch being operated by the push-buttons *V*. This collet, although it is one of the minor features of the ma-

chine, is one of the most novel ones and has an important effect upon its operation.

At Fig. 167 is a view of the chuck with the collet in place, and it is especially noticeable that the overhang from the main spindle bearing has been made very small, this having been accomplished mainly by forging the chuck solid with the spindle, instead of screwing it on as usual. This view also shows the lever V by the movement of which any one of three different rates of feed are instantly obtained. The lever moves the gear segment U at the rear, which in turn moves the rack W. The arrangement is also shown in the rear view of the machine, Fig. 168, the rod on which the rack teeth are cut shifting the feed from one to the other of three sets of gears which are encased at A, all feeds of the machine being positive and any feed instantly obtainable without stopping the machine.

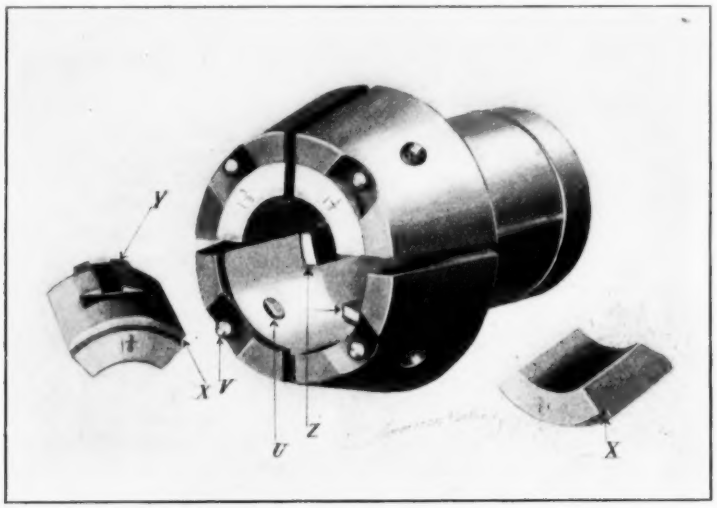


FIG. 166. SPRING COLLET AND INTERCHANGEABLE BUSHINGS.

The new turning tool is shown at Fig. 169, in which the construction and the various adjustments will be readily made out. The tool holder proper is pivoted at the bottom and the tool is moved out of its cut by swinging the lever at the top, which turns the eccentric, the screw at the right of the eccentric being the one by means of which the adjustment to size is made. The facility with which the tool may be moved away from the work at the end of a cut avoids the necessity for marring the work in running it off.

The machine as at first built had an automatic bar feed which was driven from the spindle, and thus the feed was made rather slow when the stock was of large diameter and the spindle speed therefore reduced. In this improved machine the feed rolls have been arranged to be operated directly by the operator by means of a lever, so that the feed may be equally quick, regardless of the speed of the machine—and in fact the bar may be fed when the spindle is not rotating at all. In adjusting the guide fingers and feed rolls to the size of bar that is to be worked, only one screw is to be turned, and when, by the manipulation of this screw the guide fingers have been adjusted so that the bar just slides through them easily, the feed rolls will have just the right pressure upon the bar, without further attention.

NEW AUTOMATIC SPUR AND BEVEL GEAR CUTTING MACHINE BY THE BROWN & SHARPE MANUFACTURING COMPANY.

In Figs. 171 and 172 are given a front and a rear view of an automatic gear cutter which was shown at Paris for the first time by the Brown & Sharpe Manufacturing Company, of Providence, R. I. In general appearance it resembles their machine which cuts spur gears only; but of course the fact that it is also adapted to cutting bevel gears introduces some problems of design which have been solved in a very interesting way.

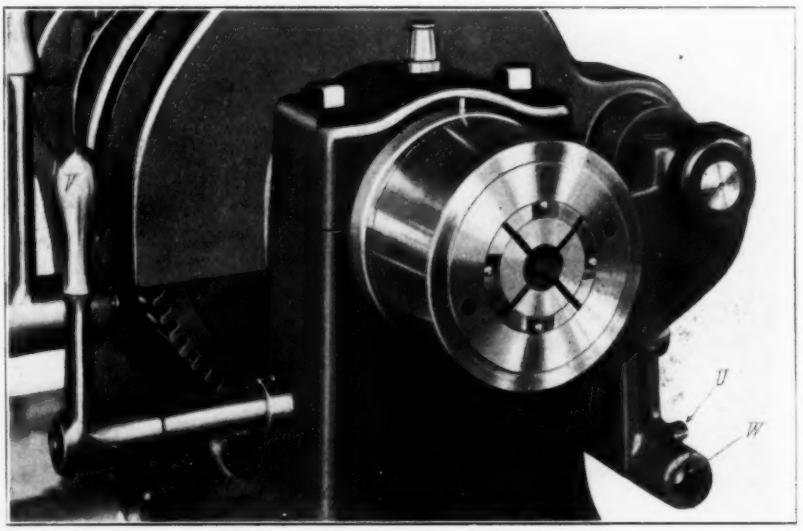


FIG. 167. VIEW OF CHUCK WITH COLLET IN PLACE.

There is a saddle resting directly upon the bed of the machine in the usual way, and this is moved upon the bed by a rack and pinion movement to bring the cutter arbor to the proper position, there being a stop which insures that it will be returned to the proper position when it has been moved for convenience in removing work or putting in a blank. Upon this saddle there is hinged a quadrant, which is elevated to any desired angle by means of a pinion gearing into teeth cut upon its periphery, and this quadrant is graduated to show the angle to which it is set in half degrees. At the top of the quadrant is a slide upon which the saddle carrying the cutter spindle moves, and motion is imparted to the cutter spindle from a pulley at the side of the machine (Fig. 172) through bevel gears to the splined shaft placed at an angle as shown, both ends of this shaft being so supported that it automatically takes care of itself and drives equally well, regardless of the position of the lower saddle upon the bed or of the angle to which the upper slide may be set. This drive is clearly shown in Fig. 173, and it is noticeable that besides the neatness of the arrangement no belt-tighteners are required, the pulley which takes the motion being always in the same position.

The feed motion for the slide is carried through the hinge upon which the quadrant turns in such a way that it also works equally well at any angle and takes care of itself when the angle is changed to suit different gears to be cut. This motion is partly shown in Fig. 173, but better in Fig. 174, where it is easy to trace it from the horizontal shaft below up to the spur gears at the right of the upper slide and to the screw by which the saddle is finally moved. As is very well known, one of the problems connected with machines of this class which has proved most difficult of a satisfactory solution is to get an index actuating mechanism which will operate at the high speed demanded in an up-to-date machine and at the same time be able to withstand the shock and avoid the danger of over-running due to the momentum of the parts that must be moved so rap-

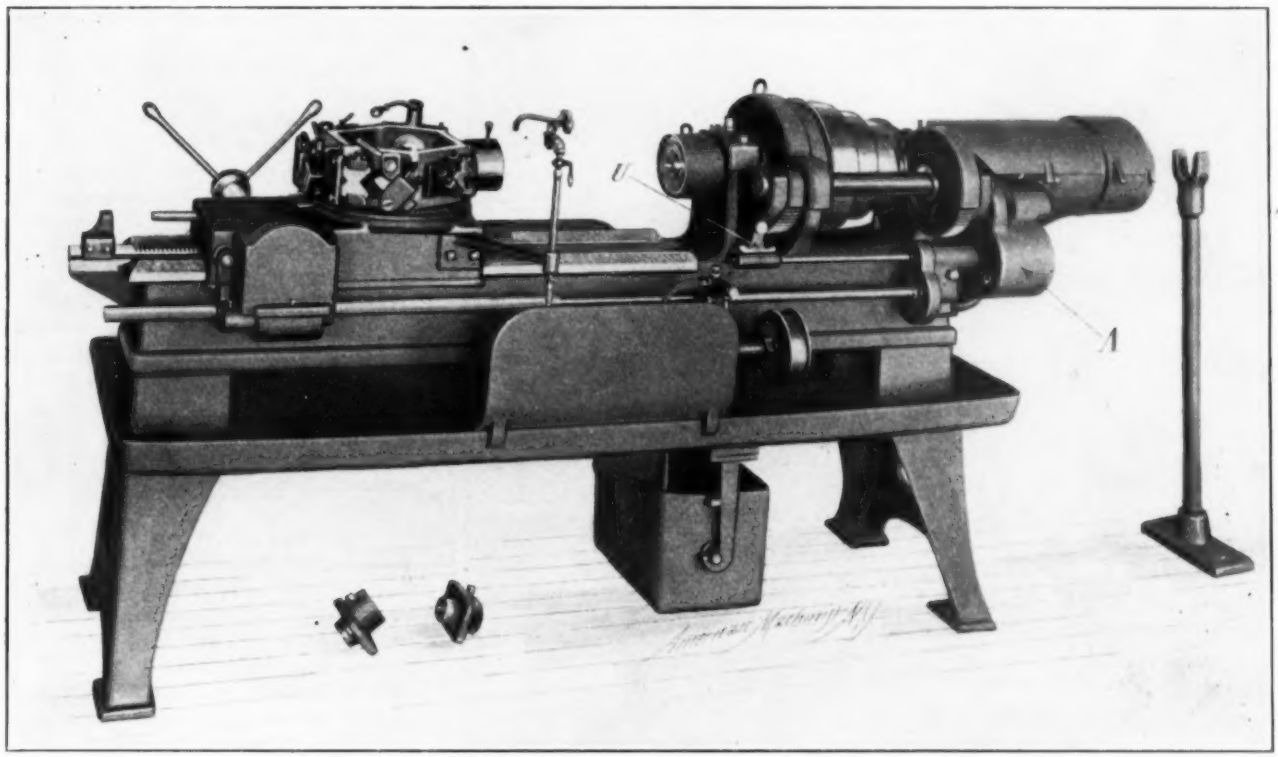


FIG. 168. REAR VIEW OF THE WARNER & SWASEY HOLLOW HEXAGON TURRET LATHE.

idly. This over-running, when it occurs, makes accurate dividing impossible because varying frictional resistance prevents the amount of movement being exactly uniform. This machine, and in fact all of the automatic gear machines shown at Paris by the Brown & Sharpe Manufacturing Company had therefore as part of their indexing motions a device which, though capable of giving the required quick movement, yet starts the parts gradually and as gradually brings them to rest. Last year, at page 468, the inventor of this device, C. R. Gabriel, described and illustrated it as a new mechanical movement possessing the interesting features of a gear driven by another gear, or pinion, which may be of any desired ratio, and though the driver may, if desired, rotate continuously, the driven gear may at one or more points in its rotation be brought gradually to rest, held stationary for a limited time and again brought up to speed, its motion being at all times strictly controlled and the starting and stopping being entirely without shocks. Those who wish to study the kinematics of the device are referred to Mr. Gabriel's article, but the form in which it is applied to the machine under consideration is shown at Fig. 175, in which *a* is the driving pinion and *b* the driven wheel, the ratio in this case being 2.75 to 1; *c c'* are the rollers on the face of the pinion which engage with the cam *d* on the gear and by the omission of a suitable number of teeth on the gear at that point are permitted to control the movement of the gear by their engagement with the cam. The rolls

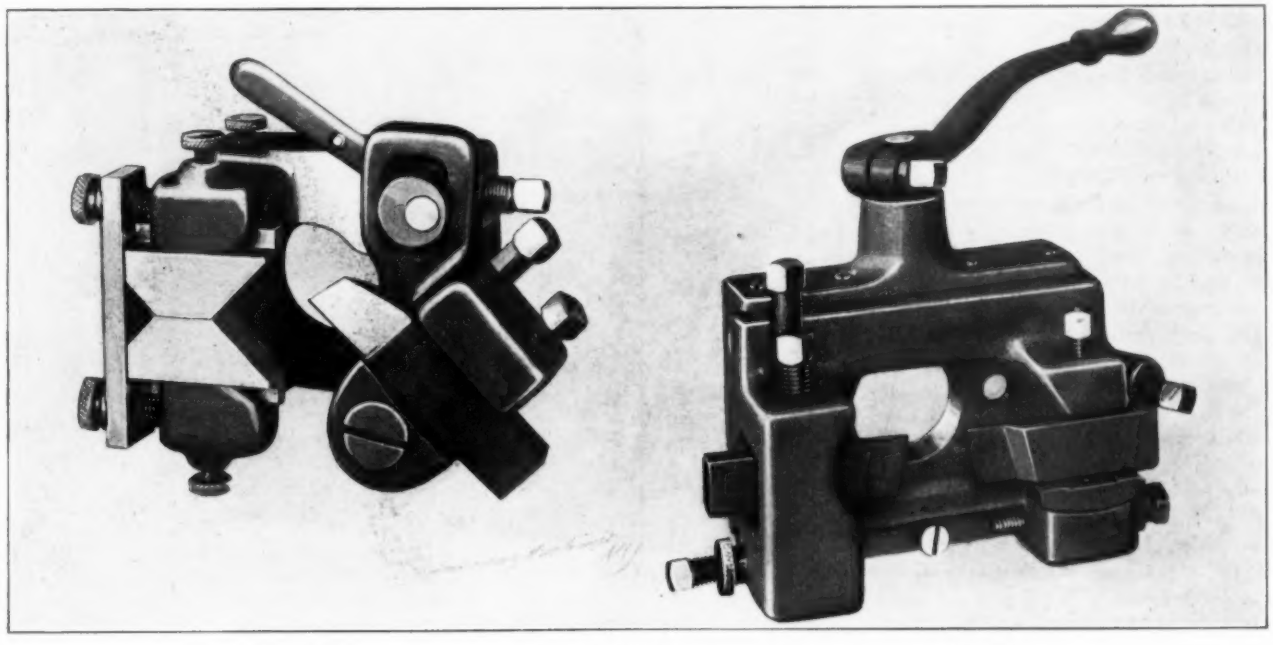


FIG. 169. TURNING TOOL. FIG. 170.

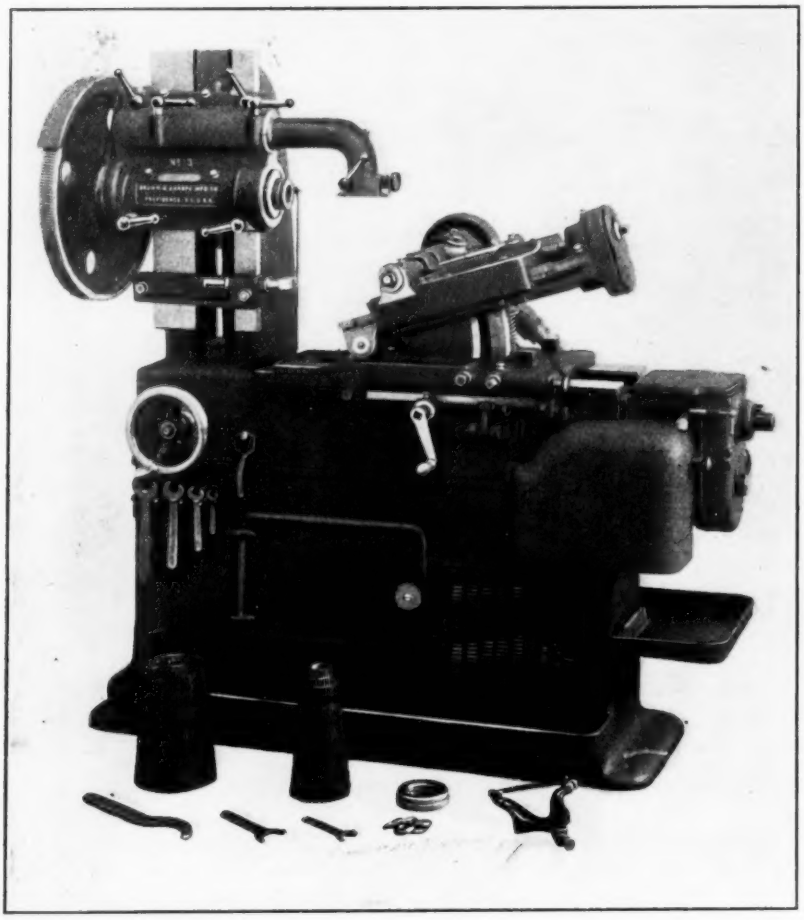


FIG. 171. AUTOMATIC SPUR AND BEVEL GEAR CUTTING MACHINE SHOWN AT PARIS BY THE BROWN & SHARPE MANUFACTURING COMPANY.

$c\,c'$ are at the pitch line of the pinion and it is therefore evident that when the roll that is moving the gear reaches the line which joins the centers of the pinion and gear, the gear is being at that instant driven at the same speed as though the teeth were engaged in the usual manner. At this point the regular teeth take up the motion and continue it until the cam is again engaged between the rollers and gradually brought to rest. In this machine of course the driving pinion does not rotate continuously, but is brought to rest by other stop mechanism when in the position shown and the cut is then made, after which the gear *b* is turned once for the indexing. And owing to the fact that there may be an appreciable dwell of the driven gear while the pinion continues to rotate, the latter may vary in its stopping point anywhere within these limits without thereby causing the driven gear *d* to rotate more or less than exactly one turn. No one can see the machine operating with this device without being strongly impressed by its great value. The very high speeds at which such machines are now required to work cause a shock to the indexing mechanism, which is at once seen to be inconsistent with the greatest accuracy and durability. By the use of Mr. Gabriel's device this shock is entirely eliminated, though the speed may be even greater than before.

The indexing motion and the backward movement of the slide are always the same, and as fast as it is practicable to make them, regardless of the rate of feed or the speed of the cutter spindle.

Fig. 176 is a section through the feed works showing how shaft *A* is driven by the worm-wheel *a* for the feed and by the spur gear *b* for the quick return, a clutch playing between them, which clutch is moved automatically at the proper times and is held in engagement by the spring plungers shown. The backing motion of the slide is very rapid, and to avoid injurious shock when the clutch is engaged with the spur gear, cushion blocks *c c* are inserted in suitable pockets formed within the gear.

At a certain point in the travel of the cutter arbor saddle it is necessary to trip the mechanism by which the motion of the slide is reversed, stopped, the indexing movement made and the saddle again moved forward. Owing to the fact that this slide upon which the saddle moves may be set any angle, from the horizontal to 5 degrees beyond the vertical position, it was not found practicable to place the tappet upon this slide and to have it act properly regardless of its position. Therefore a special device was adopted for this, which is very ingenious, interesting and, I believe, new. The feed shaft *A*, Fig. 176, drives the worm-wheel *B*, and the other view of this shaft and wheel is given at Fig. 177, where worm-wheel *B* is

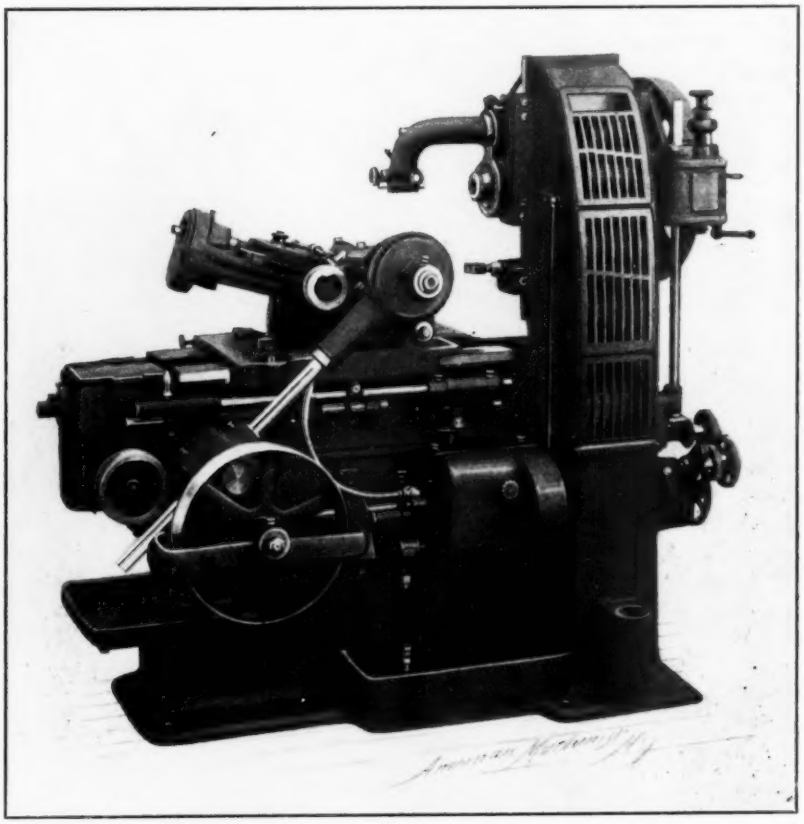


FIG. 172. REAR VIEW OF SPUR AND BEVEL GEAR CUTTER.

seen to be upon a short shaft at the other end of which is the worm-wheel *C*, engaging with the screw *E*. Screw *E* does not, however, really act as a screw, but as a rack, being simply moved endwise by the rotation of *C*, and its movement therefore corresponds to and represents the movement of the cutter slide; but of course it always moves in a horizontal line and remains in the same axial position. Fitted to it is a stop which engages with the movable tappets on the parallel rod *E*, and the stop on the rack-screw *D* can be turned upon it so as to clear the tappets on *E* whenever it is desired to move the slide beyond the limits fixed by the tappets without changing their adjustment. The rod *E*, rack-screw *D* and the stops *F F* are shown also in Fig. 173.

Fig. 177 is a section through the cutter spindle *G*, which has an endwise micrometer adjustment for accurately centering the cutter, and it will be noticed that the fixed crew *H* is very close to the cutter and also very close to the guide *I*, the

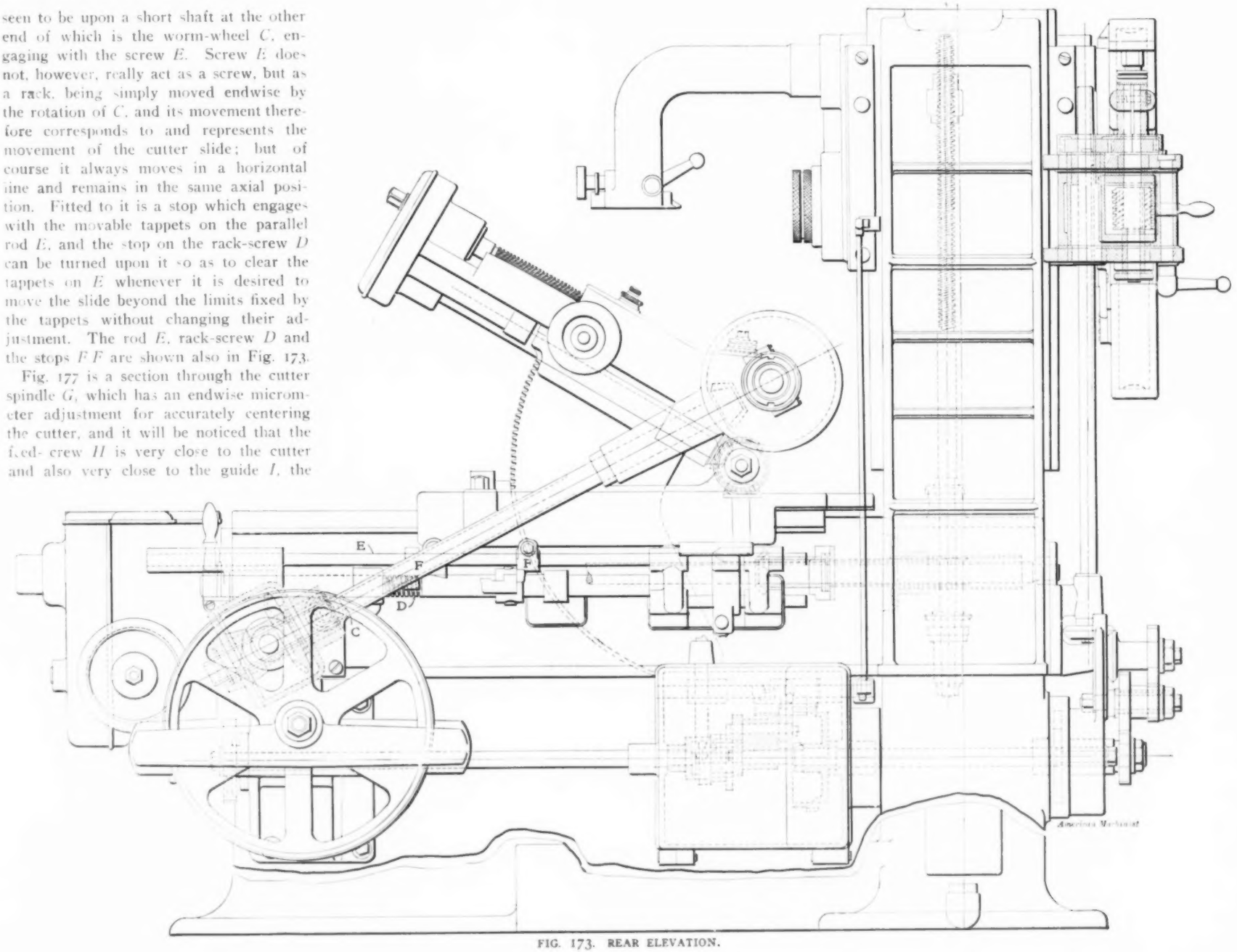


FIG. 173. REAR ELEVATION.

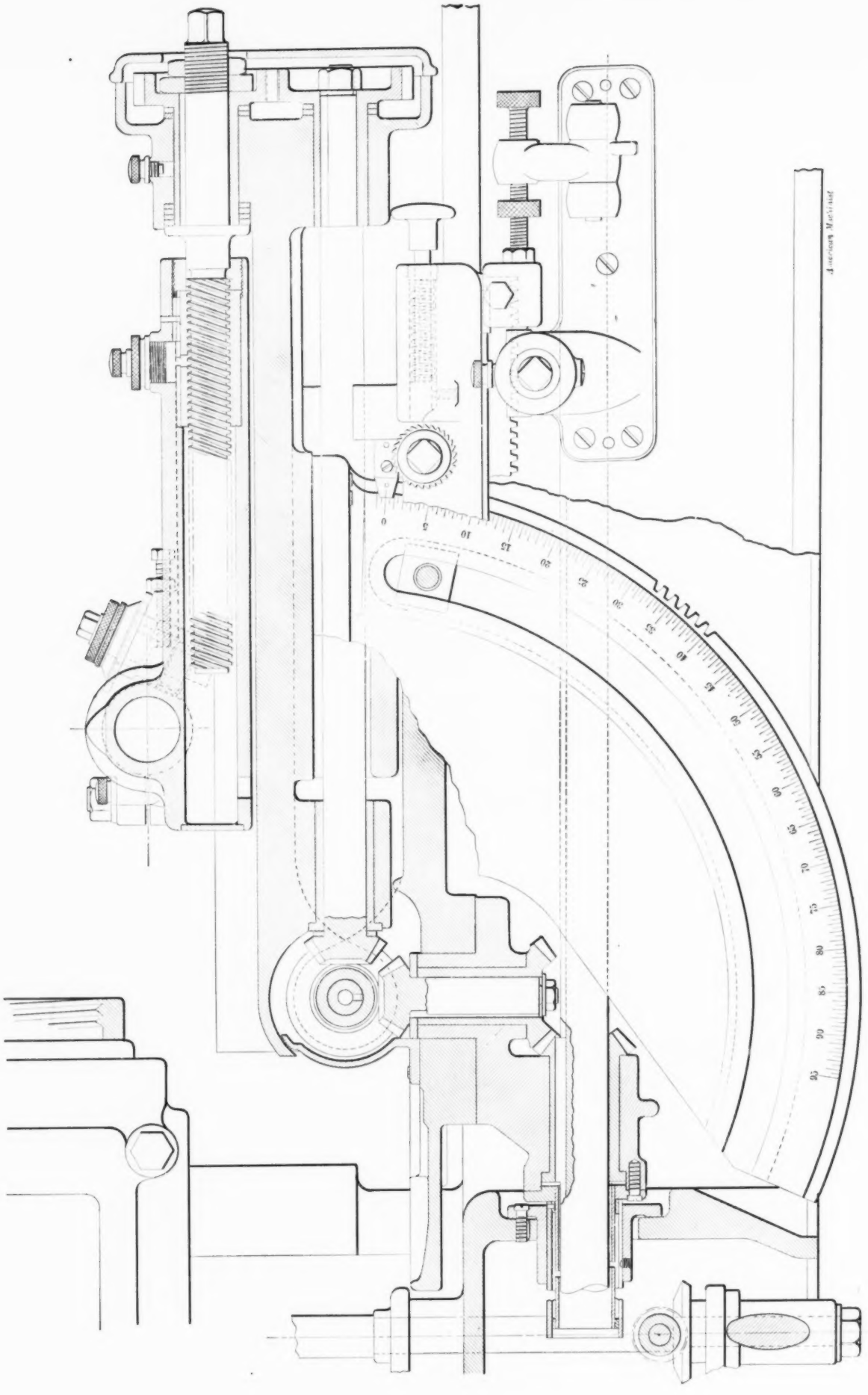


FIG. 174. FRONT SECTION OF SLIDES.

latter being narrow to bring the two lateral guiding surfaces close together, as they should be, there being no side bearing at *J*. As would naturally be expected, this machine was examined with much interest at Paris. There were very few examples of machine-tool construction shown there that possessed so many novel and interesting features. Through the courtesy and liberality of the makers we are able to give a better idea of it than would be obtainable from an inspection of the machine it-elf. F. J. M.

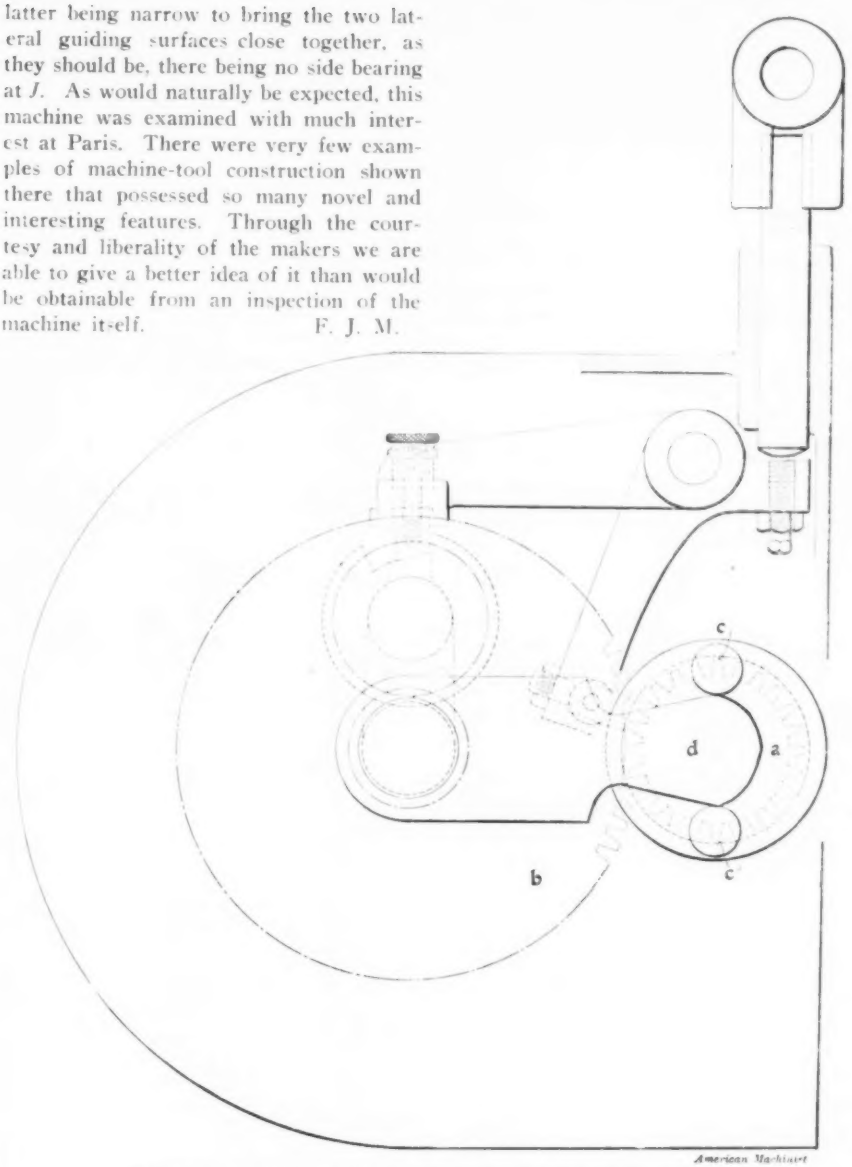


FIG. 175. INDEXING MECHANISM OF AUTOMATIC GEAR CUTTER.

Echoes From the Oil Country.

FACTS THAT KILL THEORIES.

A man was once lecturing on some subject, and in the course of his remarks he mentioned some circumstances that had come under his observation and that were unusual. At the close of his lecture he requested anyone to ask questions on any points he had not made clear. At this, a gentleman, a man of college education, arose and took exception to one narrative, said it *could* not be true, that it was against this authority and that authority, etc. After he had concluded, the lecturer asked the gentleman to tell him how much ignorance it would take to balance a fact. He had the fact; that he knew, but he did not possess the rule to show where someone else's ignorance of it caused it to cease to be a fact.

I have many times found myself in the position of the gentleman in the story, and occasionally also in that of the lecturer; but facts are stubborn things, even when we can't explain them. When a man told me he had a little direct-acting pump lifting water 32½ feet vertically, I wanted to see it and measure the hole, and when he told me he was doing it by letting air into the suction pipe, I did not dare to tell him what I thought, as he was much the larger man. After I had crawled down into the hole to the water, measured the distance and felt and heard the air going in, I concluded, as he said, "You smart fellows don't need to think we don't know anything."

Now, if that man was to tell me he was sucking water up 40 feet, I would just try to find out how much air he was letting in and try to get him to raise the pump to see whether more air, a smaller pipe and a faster running of the present pump would not raise it 50 or more feet. I told that man that 18 or 20 feet would be doing fine for that pump. I had the consolation of knowing that the City Engineer and some of the best mechanics in that city were caught the same way I was.

One of our customers has an engine he swears by as being the most economical in the country. I never saw but one other like it. This engine had a steam-chest divided in the middle, making really two steam-chests, one outside of the other, and had two valves. One valve lay next to the cylinder in the usual way, while the other one lay against the dividing plate, which had ports in it, and let the steam in on top of the first valve, which controlled the exhaust at all times. On top of the steam-chest, and under the governor was a slide valve that could be thrown so as to admit steam directly to the first valve, or so that it went first to the outside valve and then in to the first valve. A good ball governor sat on top of this controlling valve and held the speed very well.

In starting the engine, the steam was admitted to the inner valve, and after the load was gotten under motion and things warmed up, the controlling valve would be thrown over and the steam taken through the outside valve first, and a substantial saving was effected. I am sorry I did not get a diagram of the valves and seats, eccentric throws and settings. When I first saw it I thought the inventor had gone quite a way around to do nothing, and doubted the economy part.

In the course of time, the natural gas, which was the fuel used, proved insufficient to furnish steam at all times. At this point the owner made a demonstration that I could not get around. To do his work at the usual speed with steam going through both valves, the gas would furnish steam to do the work. Throwing the valve so that the steam passed through the one valve only required using considerable coal to help it out. That was the highest kind of a scientific demonstration to the owner.

To try to show why anything is so is rather risky business. I have found in my limited hunts for ultimate information that I get to a place where theory takes the place of knowledge, and as knowledge increases theory changes. I try to twist my own theories to fit my facts, or else get along without theories in some places.

I cannot attempt "to show" Mr. Willis just why everything was as I stated in the account of the bad steam gage at the sawmill. I only stated the facts as I remembered them. *Perhaps*, as they started with a low steam pressure, thinking it high, when the steam began going down they crowded in so much dry wood that combustion was not complete.

In Atkinson's "Ganot's Physics," page 488, I find a statement that carbon burned to get all the heat in it (to CO_2) gives more than three times as much heat as if just burned to the lowest point (to CO). Here is a chance for two losses: one from less total heat produced, and another from lower temperature produced, as the flow of heat from one body to another depends

on the difference in temperature. From a table of total heat of steam at various pressures I find that steam at 100 pounds pressure has less than ten more heat units than steam at 60 pounds, while it takes more than 1,100 heat units to put water at 70 degrees temperature into steam at 60 pounds pressure.

These figures are not carried out fine, but given in round numbers to convey principles involved. They seem to indicate that the heat required would be something like as 1,100° : 1,110°, while the working power would be nearly as 60 : 100, which would show quite a gain for the higher pressure if so.

Mr. Fulton kindly calls my attention to the fact that I did not make it very clear that the engineer was running with the ball out at the end of the lever at 100 pounds on the last day. With a steam gage showing 125 pounds the first day the men did not feel like trying to run it up to 397 pounds, if necessary, to blow the extra junk off the safety valve, as Mr. Willis intimates could have been done. Something like this has been tried here, but we are a busy people, and dislike to stop work to attend unnecessary funerals, and so do not encourage the practice. They were content to start off with the gage at 125 pounds, and then try to hold it there. Perhaps some learned reader will demonstrate this in an intelligent manner and so clear my reputation as an observer and recorder of facts, as I am only a tyro at the theoretical part of it.

I have large respect for the things that happen, though, and will give another experience. The owners of a wood-working establishment were in trouble. They fired with shavings and sawdust; had been adding machinery, and came to a place where the engine lagged. They carried 85 pounds steam pressure, used all their steam for the engine, and had to have a man to run the boiler nights to get steam for the dry kilns. The fireman was worked to skin and bone, and he had to have a boy to help him. They sold their waste wood and some shavings and found they hadn't enough left to do their work. They wanted to know if an extra flywheel on the engine or line shaft wouldn't increase the power; in fact, they were hunting for the flywheel when they first came our way and told their troubles.

As they had a new boiler, I advised running the pressure up to 100 pounds, changing the pulley on the line shaft to let the engine run faster to get power enough and steam enough. The change was made against the wisdom of the wiseacres, who reasoned that faster speed meant just that many more cylinderfuls of steam, and the higher the pressure the hotter the fire had to be, and the more fuel it took to make it hot, etc. The results as given by the owners were: lots of power, steam to use in the kilns daytimes, one man getting fat firing without help (or at least not losing any flesh and not kicking any), and so many shavings on hand that they couldn't get rid of them. They have enlarged some since, and have not yet found it advisable to put the flywheel onto the line shaft.

If this stirs up some of the boys to think for themselves I will be pleased, even if they don't think as I do. A friend of mine, after we had a rather warm dis-

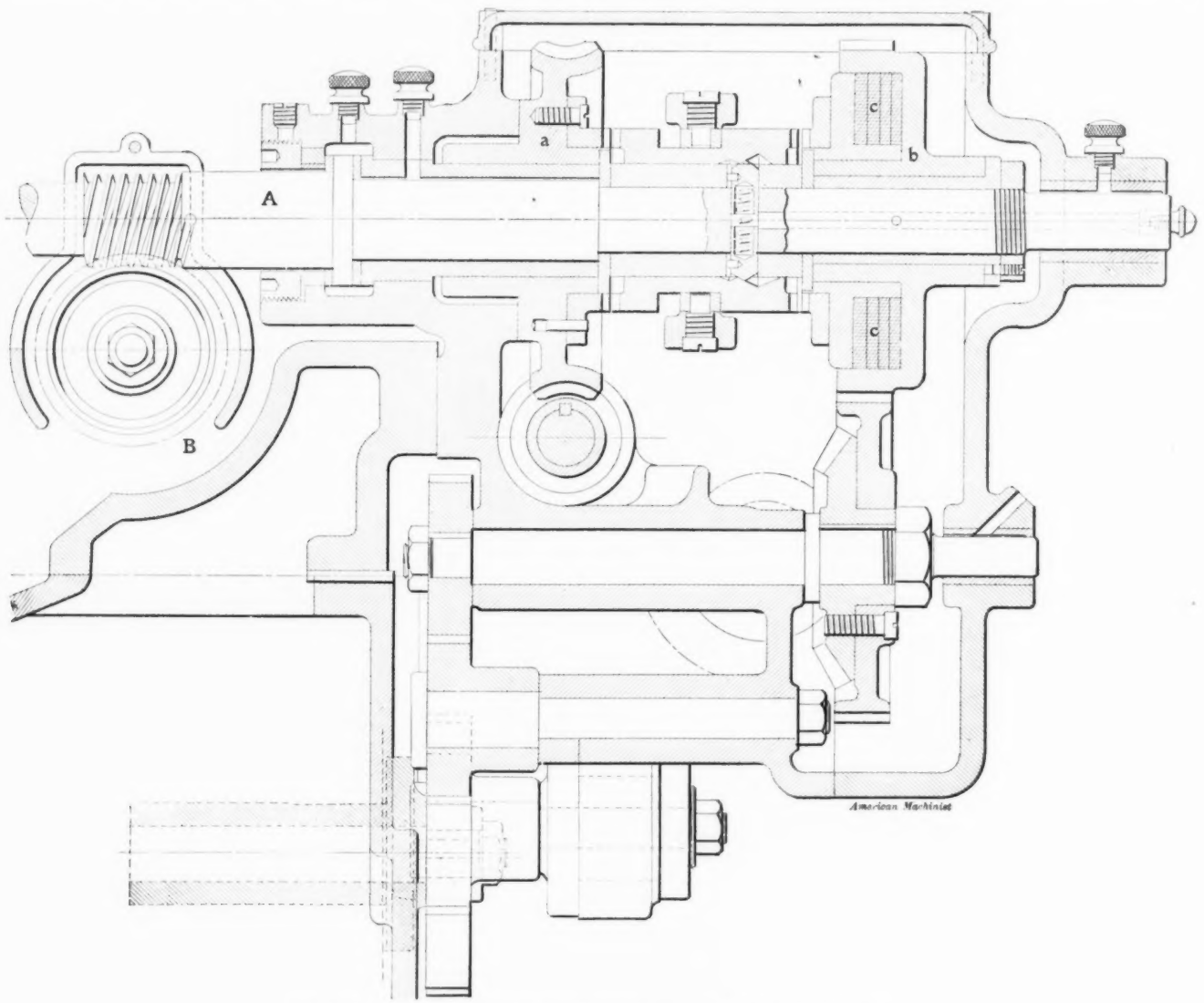


FIG. 176. SECTION THROUGH FEED WORKS OF AUTOMATIC GEAR CUTTER.

cussion on mechanical matters, remarked that it would take an awful big book to tell the things I didn't know about mechanics; but I hadn't brains enough to learn all that would be in it. Being a man of peace, I told him I fully agreed with him.

I have not told all the things that happened at that mill by any means. One story that was told to me by one of the owners (it is the sawmill that I am talking about) seemed so odd that I questioned two more of those present at the time to get their account. Each man in such a mill has his own job, and each one likes to be thought the best man that ever held that job.

One of the hard jobs at this mill was that of the off-bearer, whose business it was to take care of the slabs. He was proud of never having had to call for help. The slabs were cut up into short pieces, the hardwood was used for fuel in the neighborhood and the hemlock was made into lath. To reach the slasher-saw, the slabs had to be carried across the tracks of the saw-carriage, and, under ordinary conditions, the off-bearer had just about time enough to get across before the carriage reached him on the next forward run. One day a very large hardwood log was on the carriage. I am telling this as it was told to me. It was so rough and crooked that an extra heavy slab was made. "When that slab came off, I thought Jim was stuck and would have to have help, and was surprised to see him take hold of it. It was a hard lift, but he straightened up with it and started across the tracks, going very slowly. The sawyer stopped the carriage to give him time, and we all stood watching him. I was wondering if he could possibly make it, when suddenly I found myself looking into space. The man had disappeared from among us, and we stood like a lot of galoots, with our eyes and mouths open. Some of the men looked scared, and I never felt so like a fool in my life. The last I could mind was seeing him there before my eyes.

"After standing staring around, and at each other, we finally went to where he had been. There laid the slab flat on the floor, round side up. When we turned the slab over, we found a hole in the floor and the man in the lower part of the mill in an unconscious condition and badly hurt. The slab had covered the hole. Not one of us had any idea what had happened, and it was several minutes before we had recovered enough to find out."

This from the owner. The other men I asked about it gave me practically the same story, and they further told me not to mention it to one of the men. They said he was so worked up over it that they were afraid he would give up the job. He believed there was something supernatural about it, as he wouldn't believe that anyone could get from before his eyes like that without him seeing him go. In fact, I thought they all felt a little shaky, as they talked low and serious when telling about it, and had to be urged to tell it at all; they evidently wanted to avoid the subject.

Now, can someone with a wide experience tell how fast something we consider stable would need to move to go faster than our minds would follow? Like a lathe dropping through the floor or the bench going through the wall or your tool box going through the roof, for instance. But perhaps this is more a question for a metaphysician than for a machinist, and I only saw the man that saw the man.

W. OSBORNE.

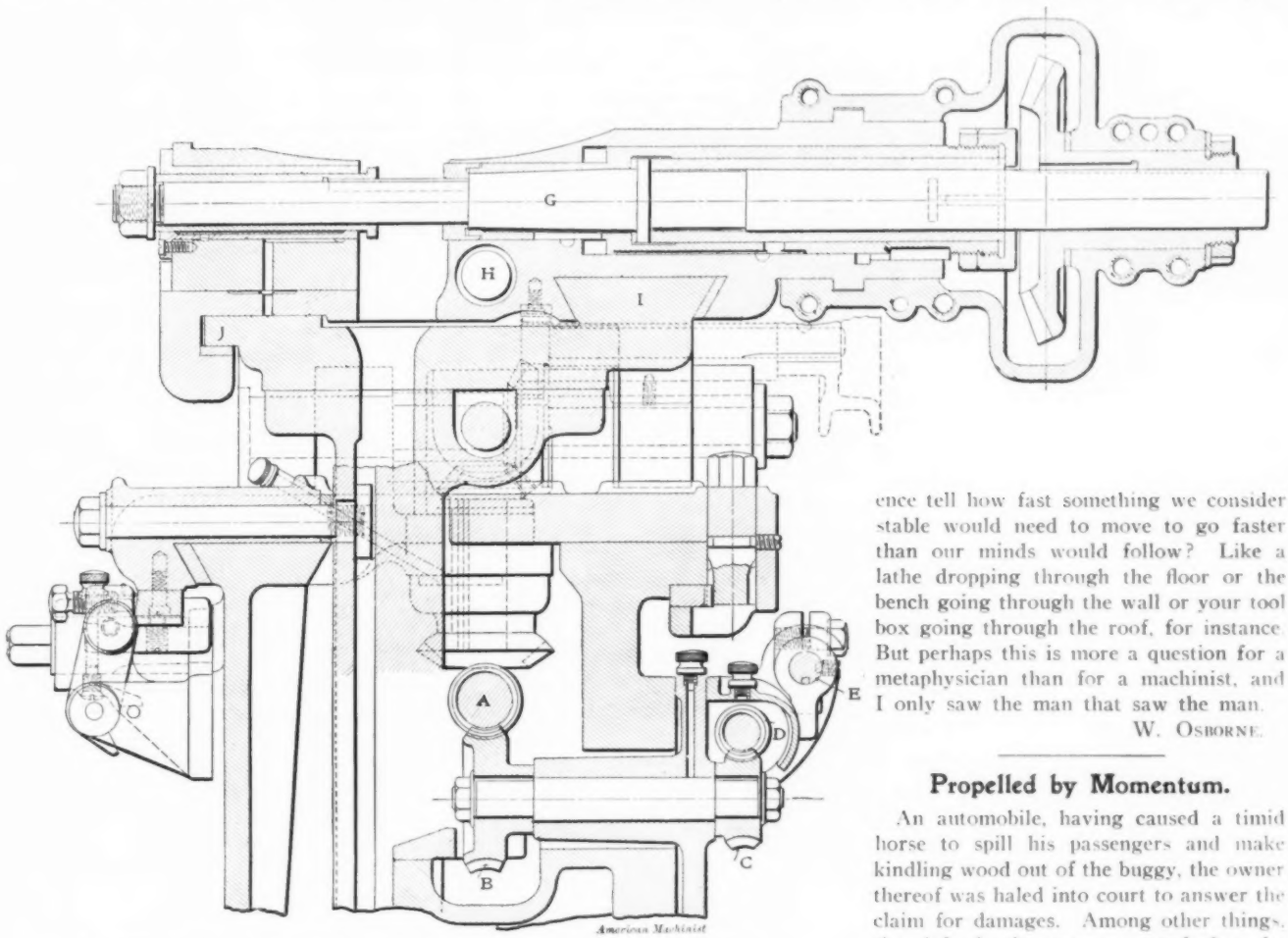


FIG. 177. SECTION THROUGH CUTTER SPINDLE OF AUTOMATIC GEAR CUTTER.

Propelled by Momentum.

An automobile, having caused a timid horse to spill his passengers and make kindling wood out of the buggy, the owner thereof was haled into court to answer the claim for damages. Among other things, the defendant's attorney urged that the automobile in question was more than ordinarily heavy and that having insufficient power it could not possibly be driven at the speed asserted by the plaintiff; to this statement the opposing lawyer took vigorous exception.

"Now, gentlemen of the jury, your own sound common sense will tell you that this is contrary to your every-day experience. Take the modern high-speed railroad train drawn by bigger and heavier engines than ever before, and the increasing weight of the fast street cars is known to you all. The fact is that the heavier the automobile the faster it will travel, *because it is propelled by its momentum as well as its steam power.*"

The jury brought in a verdict for the plaintiff accordingly. "Q."

Spacing for Prime Numbers on the Universal Milling Machine.

BY A. L. DE LEEUW.

In reference to my letter in issue No. 7, the editor expresses the opinion that it is of more importance to the readers of this paper to know how a thing may be done, than to know how it can be done; and I believe he is right. I therefore offer here a few devices which, when applied to the spiral head of the milling machine, or to any other dividing head, will accomplish the spacing for a prime number for which one does not have change gears or an index plate.

I happened to have occasion recently to apply one of these methods to the cutting of a gear with 107 teeth. This gear was cut on a Cincinnati milling machine. The sector on the spiral head was set for 108 spaces. A plug inserted in the rear end of the dividing spindle carried a 20-tooth gear. The worm-shaft carried a 54-tooth gear. (I call this the worm-shaft because it generally goes by that name, though of course I mean to indicate the small bevel-gear shaft which carries the last change gear for spiral cutting.) These gears were connected by means of an idler carried on the regular quadrant. This gives the 54-tooth gear the proper direction of rotation, and also fills up the space between the two gears. In order to make the idler reach the two gears, it was necessary to swing the quadrant up so high that the regular clamping bolt could not be used, and a machinist's clamp had to be applied to hold the quadrant in place. In this way one tooth will be lost, and the gear will be spaced for 107 teeth. Had we wished to gain one tooth, two idlers would have been necessary. The arrangement of the Cincinnati milling machine, however, will not admit of the use of two idlers in this case. As a matter of fact, it was mere luck that the above arrangement could be used at all. If the operation of spacing for prime numbers should be a frequent one, it might be advisable to rig up especially for this purpose.

Fig. 1 shows such an arrangement applied to a spiral head. The accompanying cuts are not working drawings, but diagrammatic sketches only. They are drawn without the least regard for sizes and proportions. They simply serve to illustrate the principles involved.

Fig. 1 is a sectional plan view of the spiral head of a milling machine. *A* is the index pin; *B* the index plate to which is attached the worm-wheel *C*. This worm-wheel is driven by a worm on shaft *D*, which in its turn gets its motion from change gears (here shown as being compounded). The change gears are held on a quadrant *E*, and the first change gear *F* gets its motion from the worm shaft *G* in the spiral head, by means of the miter gears *H* and shaft *I*. If the spiral head is to be used for spiral milling, the worm on shaft D must be withdrawn, so as not to lock the index plate. One can obtain the following results with this arrangement: Suppose the worm-wheel *C* has 72 teeth; the sector is arranged for cutting 72 spaces, the gear ratio in the change gears is 1, and the number of idlers is such that the index plate travels in the same direction as the index finger, then the actual number of spaces cut will be 71. With a gear ratio of 2 : 1, the spacing will be for 70. A gear ratio of 3 : 1 gives 69 spaces; 4 : 1 gives 68 spaces; 5 : 1 gives 67 spaces, etc. Relatively few change gears, and a few rows of holes in the index plate, will be sufficient for all divisions used in actual practice. The use of one more idler will increase the number of spaces, and in the same way. By chosing the change gears so that a fractional number of spaces is acquired, one can space for 2, 3, or in general n times that number, if 2, 3 or n is the denominator of the fraction. For instance, one may cut 121 spaces by arranging the mechanism for 60½ and going twice around.

The above described method is not always applicable, as the arrangement of some spiral heads does not always admit of taking the motion off the shaft *G*. Besides, the device described here would be adaptable to one spiral head only. It might therefore be better to rig up as shown in Fig. 2. Here the rigging is coupled to the miter shaft *K*. A simple stand *L* carries the entire arrangement. It is bolted to the platen of the milling machine in a similar manner, and by means of the same T-slot as used for the spiral head. It should be noted, however, that this device can be applied equally well to any dividing head, by coupling it to the worm shaft. As will be seen, this device consists of an index finger *M*, an index plate *N*, the usual sector (not shown here), a sleeve *O*, to which the index plate is keyed; change gears *P* (one of which is keyed to the shaft *Q*, while the other is keyed to a hub *R*, which also carries the gear *S* and runs on the stud *T*); a quadrant, not shown here, carrying one or two idlers to connect the gears *P* and the gear *U*, keyed to the sleeve *O*. The proper change gears are first put in place, after which the whole device is coupled to the dividing head. It is of course understood that instead of making the gears *S* and *U* equal, any gear ratio, or even a worm and worm-wheel, might be substituted; in which case the result will be correspondingly changed.

If the sector is set for, say, 60 teeth, change gears in ratio of 1 : 2 will give 30 spaces; 1 : 3 will give 40 spaces; 2 : 3 will give 20 spaces; 1 : 4 will give 45 spaces; 3 : 4 will give 15 spaces; in general, a ratio of $a : b$ will give $60 \times \frac{b-a}{b}$ spaces. The arrangement as sketched would be useful if applied to an ordinary dividing head or centers. An index plate with one or two rows of holes, or even a few notches, and a few change gears, would be sufficient for almost all cases, for which such a dividing head could be used. For instance, let us suppose a disk is used with 24 holes, and the shaft *K* is the dividing spindle. Then the following divisions could be made without any further mechanism, *i. e.*, by locking the index plate: 1, 2, 3, 4, 6, 8, 12, 24.

By using change gears in ratio of 1 : 3, division 16 is added; by using a ratio of 1 : 4, 9 and 18 are added; by using a ratio of 2 : 7, all the figures of the first row will be multiplied by 5, *i. e.*, one can divide for 5, 10, 15, 20, 30, 40, 60 and 120 divisions, etc.

Making $a = b$ in the formula will show that even gears would not lead to any division—that is, a gear ratio of 1 : 1 cannot be used. Analyzing this case a little further, it appears that if a gear ratio greater than 1 is used, the index finger does not overtake the index plate any more, but the index plate overtakes the index finger. The formula still holds good, as the numerator $b-a$ becomes negative, while the denominator remains positive. This property of the device, when intelligently applied, enables one to save change gears. For instance, a gear ratio of 3 : 2 will do the same as a gear ratio 1 : 2.

If a worm and worm-wheel are used, then the device becomes more applicable to the spacing for prime numbers. For instance, if a worm-wheel with 72 teeth were used (any other number will do) and one wished to cut 59 spaces, the sector would be set for 60 spaces, and change gears in ratio of 72 : 60 (or 6 : 5) should be used.

Fig. 3 shows a similar arrangement, though of somewhat different construction. The handling and application are exactly the same as that of the device shown in Fig. 2. In this case, however, the index plate is stationary (the figure shows it keyed to the framework). The index pin, in this case, drives bevel gear *V*, which is the first bevel gear of a jack-in-the-box. The last bevel gear of this system marked *W* has keyed to its hub the worm-wheel *X*, which, by means of a worm, miter gears and the change gears *Y* is driven by the shaft *Z*.

If the sector is set for n spaces and the total gear ratio of change gears and worm and worm-wheel is $a : b$, then this arrangement will space for $n \times \frac{2b-a}{b}$ spaces.

Finally, Fig. 4 is shown here as a curiosity. It is practically the same device as shown in Fig. 3, except that both the shaft *Z* and the index plate *N* get a differential motion. If the total gear ratio between the shaft *Z* and gear *U* is $a : b$, and the total gear ratio between the shaft *Z* and the index plate *N* is $c : d$, and the sector is set for n spaces, then this arrangement will space for $n \times \frac{2b-a}{b} \times \frac{d-c}{d}$

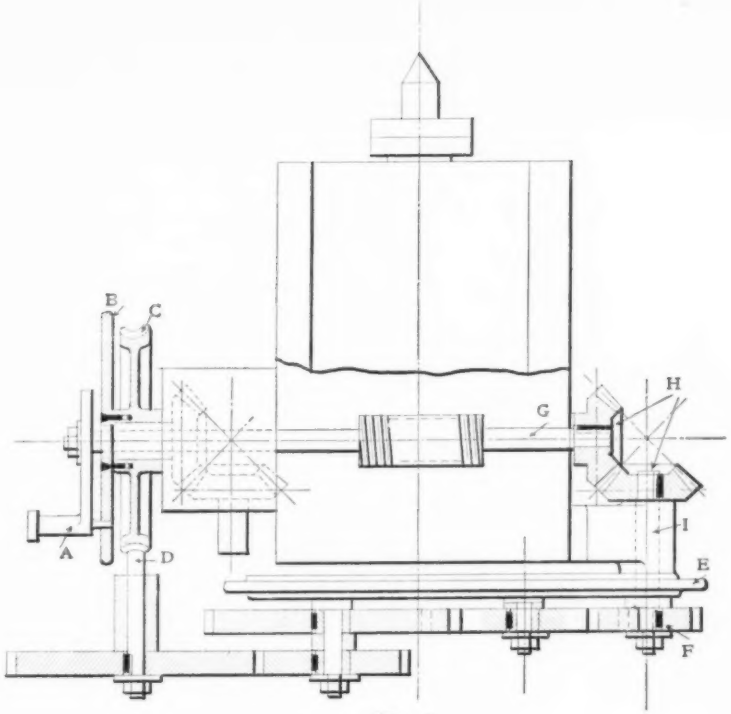


Fig. 1

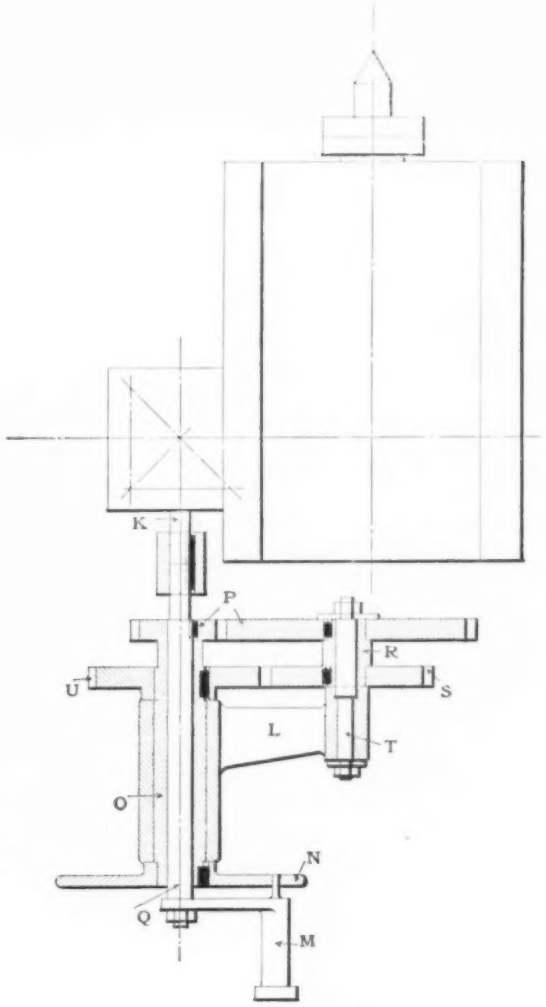


Fig. 2

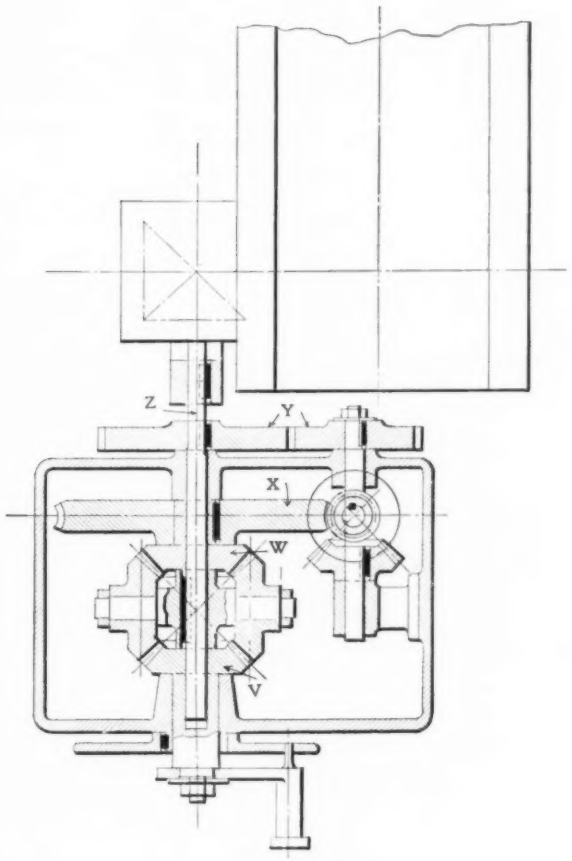


Fig. 3

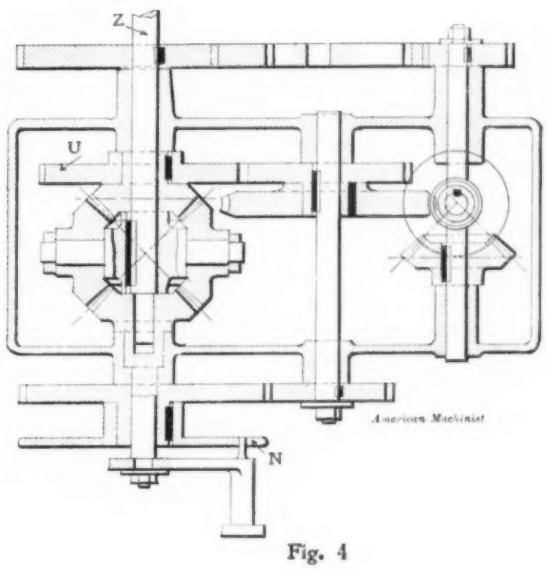


Fig. 4

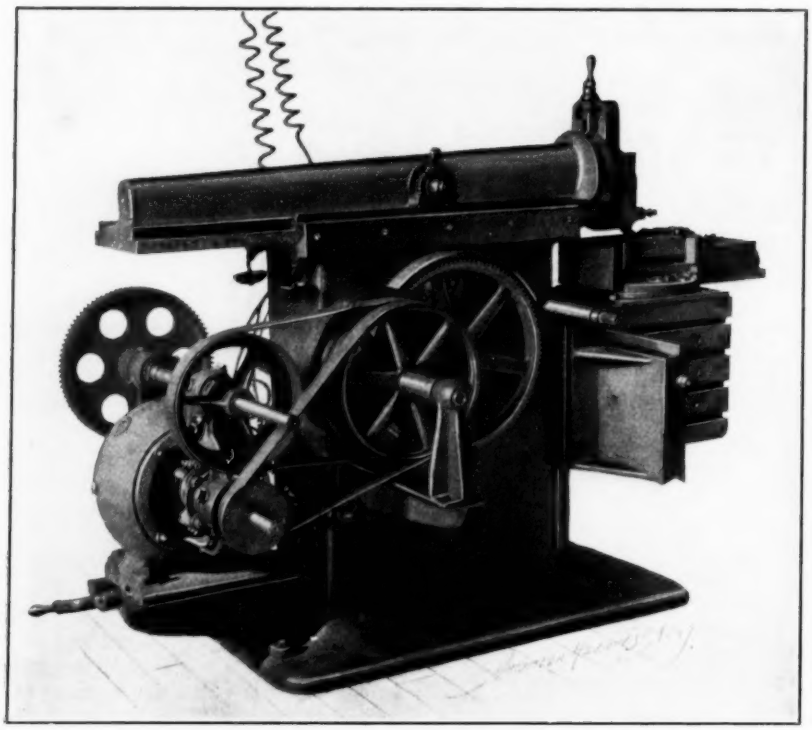
ATTACHMENTS TO INDEX HEAD TO PERMIT SPACING FOR PRIME NUMBERS.

spaces. It is almost unnecessary to say that the methods here described are not the only ones possible. In fact, the underlying principle admits of an unlimited number of variations.

The new machine shop equipment of the Sheffield (Eng.) University College, selected by Prof. Ripper, principal of the college, includes the following American tools: A 6-inch Hendey-Norton toolroom lathe; a Walker universal cutter grinder, of the Norton Emery Wheel Company; a quick-return planer of the L. W. Pond Company, and an emery tool grinder of the Diamond Machine Company.

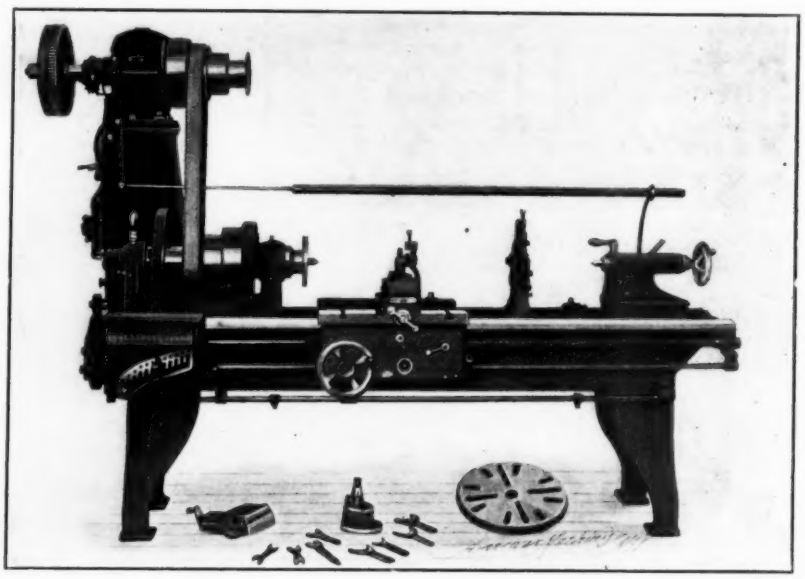
Motor-Driven Hendey Shaper and Lathe.

The accompanying illustration shows the method adopted by the Hendey Machine Company, of Torrington, Conn., for driving their well-known shaper by an electric motor. The motor in this case was built by the Northern Electric Company, of Madison, Wis., and the reduction shaft, which in this case is shown above the motor, can be turned to any one of four different positions, the standards by which this shaft is supported being attached to rings which are turned into a recess formed at each end of the field ring. The bolt holes being spaced equally permit the standards to be turned to any convenient position about the motor, with the armature shaft as a center. In this case the design lends itself very well to the use made of it because the backing motion of the ram is taken direct from the armature shaft by the lower one of the two belts shown and the backing speed is constant. The forward motion, however, is taken from the second or reduction shaft and from a two-step cone pulley placed on the shaft so that the cutting speed is not only slower, but may be varied without altering the backing speed, which remains always at the maximum regardless of the changes made in the cutting speed. As the two driving shafts rotate in opposite directions, an open belt is used in both cases and the arrangement seems especially well adapted to the purpose. As will be noticed, the motor is mounted upon a bracket or shelf attached in a substantial manner to the column and flange of the shaper and the motor itself can be moved upon this bracket to adjust the belt tension.



MOTOR-DRIVEN HENDEY SHAPER.

We give also a view of an 18-inch Hendey-Norton lathe with 8-foot bed, which was built by the same company for use in the new United States Mint at Philadelphia. The general features of the lathe are the same as those with which our readers are familiar, but it has been adapted to drive by an electric motor, and in doing this some unique arrangements have been adopted.



HENDEY-NORTON MOTOR-DRIVEN LATHE.

As will be seen, the motor is placed on top of a bracket or standard bolted to the rear side of the lathe bed. This raises the motor as high as the available head-room would permit, and from the motor a secondary shaft is driven at two different speeds by means of two pinions placed side by side on the armature shaft, these pinions being of different sizes and driving into the spur gears shown on the upper cone shaft. Between the gears there is a friction clutch similar to that which is used in the Hendey shaper. This clutch is worked by a shipper to which the horizontal rod passing along the front of the lathe is attached, and by shifting this one way or the other not only the two different speeds of the upper cone are obtained, but in its mid position the lathe is stopped without stopping or starting the motor each time the lathe must be started or stopped. This makes the handling of the lathe more convenient than it would be otherwise, and the drive is of course by belt in the usual manner, giving the usual eight changes of speed, or a total, with the back gears, of sixteen changes.

Letters from Practical Men

Teachers for Manual Training Schools.

Editor American Machinist:

The recent articles in the "American Machinist" on "Teachers for Manual-Training Schools" have been very interesting to me.

In discussing manual-training work, we must not lose sight—as some of your correspondents have done—of the fact that the manual-training school is not a trade school, and that manual training has an educational value as well as a practical or utilitarian value. Manual training, as taught in the public schools of this country, does not aim to produce draftsmen,

machinists or blacksmiths. It does aim to teach the boy how to use his hands in manual operations, to make him accurate and self-reliant. Manual dexterity is not alone the aim. The boy must be able to conceive, to plan, and then carry out his project to a successful issue. He must not only have knowledge, but also the ability to use his knowledge.

While the teacher of manual training should be a practical man and should have a thorough knowledge of his specialty, he must also have a knowledge of the aims and value of manual training. He needs, in addition, patience, perseverence, tact and sympathy. In other words, he must be a teacher. In my estimation, it requires as skillful a teacher to instruct in mechanical drawing or shopwork as in science, mathematics or languages. We have had altogether too much of the idea that any person can teach.

The university graduate often makes a failure in teaching his special subject to high-school students, and the expert mechanic will as often fail in teaching shopwork to the same class of students. He would be more likely to succeed in a technical school of college grade or in a trade school. Expert knowledge is far from being the only qualification for a good teacher in any subject.

We must not judge manual-training work, as a whole, by the work done in any one school. This work is comparatively new, and the aims and methods are not the same in all schools. Very few manual-training schools teach mechanical drawing after the fashion mentioned by "M. A. J." in No. 7. We do not in Toledo. We do claim to teach students of high-school grade to make neat and accurate working drawings of existing machines. The student goes to the machine shop, for example, and makes a sketch of some part of a machine. He then returns to the drawing room and makes his finished drawing from this sketch. We aim to teach them, also, the elements of orthographic projection, development of surfaces, isometric projection, perspective, cam and gear design. The aim is to make the work conform so far as practicable to the methods used in shop drafting rooms. F. T. CARLTON.

Toledo Polytechnic School.

Teachers for Manual Training Schools.

Editor American Machinist:

In your issues No. 2 and No. 7 a subject is discussed which I believe should be kept agoing and if possible brought to the eyes of the school committees everywhere. Mr. Stanwood has gotten at the core of the manual-training problem in a very short and direct manner, and I doubt if I can add anything to it.

One of the letters in No. 7, signed "A Teacher," takes the ground that the majority of the teachers in our technical schools and manual-training schools are selected from the mechanics who have worked in the shops. This may be true of the former, but certainly is not of the latter in New England, and assuming that New England teachers are average teachers it is not true of the whole country. On this hypothesis 85 per cent. of the teachers engaged in manual training are simply graduates of our technical schools with no other training as artisans.

The questions put to a candidate, I believe, are more often "Where and when did you graduate?" and "What is the smallest salary you will accept?" than any which refer to his ability as an artisan. In fact some committees will not consider an application unless the candidate is a technical graduate. The salary generally given for the first year is from $600 to $750. What self-respecting mechanic, such as are required for this profession, will look at such a salary?

To return again to the technical graduate, what kind of a graduate is most likely to be found teaching manual training? The man who has good natural mechanical ability, who can design a practical machine and build it afterwards, or the man who just pulls through and knows a monkey-wrench from a hammer and a lathe from a milling machine but cannot do a good job with any of them? Generally the latter is the choice of the committee if the former applies for a position at all. The first man is sure of himself and dares to start among mechanics; the latter thinks what is before him, his legs shake, his heart goes pit-a-pat, and he becomes a manual-training teacher.

I have now in mind a man who has as many mechanical ideas as a dry-goods clerk, but who is one of the smoothest talkers outside of mechanics I ever knew; a technical graduate, but absolutely unfitted for his work, except the bluff part. To illustrate, one of his pupils asked him the use of the intermediate gear bracket on one of his lathes. His reply was "it relieves the strain on the machine."

Of course, there are good mechanics and artisans in the profession, but the poor far outnumber the good.

This letter has grown longer than I anticipated, but I trust the subject can be occasionally warmed up until those having the power will materially change affairs. X. Y. Z.

Teachers for Manual Training Schools.

Editor American Machinist:

The discussion in your columns on the subject of "Teachers for Manual Training Schools" shows conclusively that more than a passing interest is being taken in the subject of technical education. The letters of "M. A. J." and "A Teacher," in issue No. 7, are especially interesting, in that they are characteristic of the wide difference of opinion that exists in the public mind as to the scope, methods and work of these schools.

"M. A. J." has an entirely wrong conception of the aims of these schools, if he expects them to train skilled artisans. He may be surprised to learn that the most advanced workers along this line of educational work make no such claims. In fact, the tendency among them is, I believe, to make a sharp distinction between the work of the manual training school (which is primarily educational in its character) and that of the trade school, which latter has for its principal aim the training of the artisan.

In this country there are but comparatively few trade schools, in the proper sense of the term. It is perhaps due to this fact that this wrong conception of the work of our manual training schools exists. This misconception I believe is shared by parent and pupil. Although I have met many graduates of manual training schools, I can't at this time recall one who was conversant with the fundamental principles on which this system of education is based.

In the majority of manual training schools, the mechanical processes are performed for their educational value alone. The performance of these processes aids the pupil in carrying on more successfully the purely mental work of the school. The end sought for, however, does not necessarily bear any relation whatever to his ultimate fitness for entrance as apprentice or journeyman to our workshops and factories. An analysis of most of the mechanical processes of these schools will, I believe, bear out the above statements. For instance, of what value, from the artisan's point of view, are most of the exercises in sloyd or woodturning? Practically of no value, because of the fact that methods are followed that are obsolete, and that would not for a moment be considered as applicable to our shops or factories. And yet there cannot be much doubt that these exercises have an important value as a means for developing the eye, the hand and the mind. The exercises are chosen because they are considered to have a large educational value, their practical value being considered as of secondary importance.

What is true of the exercises in wood working is also true, in a greater or less degree, of the exercises in the other departments. It is in the trade school that the practical value of the mechanical processes is considered of vital importance. Here thoroughly up-to-date methods are followed, and it is the aim of the school to fit the pupil to do the work, in the same manner that would be required of the apprentice in the workshop. Limitations of equipment generally make it impossible to reach ideal methods of carrying on the work, but nevertheless the efforts of all connected with the school are directed towards the accomplishment of practical results. In other words, efforts are made to

equip the pupils with knowledge that will immediately have a dollars-and-cents value.

Recognizing, then, that there is a difference in the scope of the two schools, it does not necessarily follow that the successful shop man will be a successful manual training teacher. The value of practical experience must not be underestimated, neither must the value of a general education. The successful teacher must be endowed with both; that is, he must have acquired success in the shop as well as at the training school.

It will be possible to obtain teachers with the necessary qualifications, when the compensation is fixed at such a figure as will guarantee a fair investment on the time and money spent in training in the shop and at college. Six hundred to eight hundred dollars a year will hardly do it. Until boards of education and the public at large realize this fact, so long will we have mediocre teachers in our manual training schools. DEKE.

Teachers for Manual Training Schools.

Editor American Machinist:

Your issue No. 7, this year, contains an article on what "M. A. J." considers the essential qualifications for a teacher of manual training, in which he also intimates that manual-training schools are conducted for the purpose of developing and turning out into the manufacturing establishments broadcast, full-fledged and mature mechanics. He also says that these "mechanics" do not come up to the standard of requirements or expectations, and are usually deficient and lacking in mechanical skill. With the latter part of this article, I agree with him perfectly, and shall not contest. But it is the qualifications of the teacher and the functions of the school that I wish to clearly define.

My answer as to the teacher, and the absolutely necessary qualifications for him to possess, will be found in my article published in the same issue of your paper as that of "M. A. J.," and it will be unnecessary for me to go into any further details on that subject, as my views are there clearly stated and cannot possibly be misunderstood. But it is on the functions, aims and purpose of these schools that I wish to write a few lines.

There seems to be an erroneous impression that the manual-training school has for its object and purpose the teaching of mechanical trades to boys and young men and fitting them to go into the workshop and compete, if possible, with regular shop-taught mechanics. Such impressions are erroneous and misleading, for this is not the aim of these schools at all. Manual training is clearly defined by Mr. William I. Crane, who says: "I would define manual training as the cultivation of the hand, so that it may be able to express the ideas of the mind; to serve as an adjustment between mind and matter; to be the complement of the mind in man's struggle for the control of his environment." The definition adopted by the American Manual-Training Teachers' Association is as follows: "Manual training is any form of constructive work that serves to develop the power of the pupil through spontaneous and intelligent self-activity."

Such definitions as these should immediately dislodge all erroneous and misconceived ideas of this particular branch of education. Because we instruct boys or girls in the use of a saw, plane or chisel, or to do a little turning on an engine lathe, it does not necessarily follow that we propose to have them develop into carpenters or machinists. The idea of introducing this kind of work into our schools is to make the pupils think, to act and to develop more or less, according to their mental abilities, their inventive faculties. For illustration, let me take the making of a towel roller, as this involves the use of bench tools and the turning lathe. In the first place, we require the pupils to make a drawing of the model they wish to construct. This leads them to think, to study, and finally, to execute a drawing of a model such as they think will answer the purpose. This design is then carefully examined by the teacher and corrections made if necessary, so that the finished product may be proportioned correctly. Then the pupil will calculate the amount of stock required and cut it out, by which process he learns to saw. He will then lay out his design upon the wood, after which he cuts it out with the proper tools; then he turns the roller, which teaches him something about a lathe. Finally, comes the assembling of the different parts, the varnishing and polishing; after which the model is finished, and he takes it home to receive the praises and congratulations of his family, which makes him proud of his achievement and spurs him on to other undertakings of a more difficult nature, thereby developing faculties which might otherwise have remained dormant.

Then again, manual training is introduced into our schools because the boy who is skilled in the handling and use of tools will make a better dentist, a better surgeon, a better engineer, and, in fact, a better man in any profession or business than the boy who knows nothing about the use of tools.

These facts, I think, should dispel the notion of the most skeptical that a manual-training school teaches boys a trade, or even attempts to fit them so that they can compete with a third-rate mechanic, to say nothing of a first-class workman. Trades cannot be learned or taught in such schools. This kind of work we must necessarily leave to the workshop or the trade school, the latter being often confounded with the manual-training school. A TEACHER.

Proportions of Gears—Patterns for Gear Teeth—Stuffing Boxes.

Editor American Machinist:

The accompanying diagram, Fig. 1, has been used by me for some years, and if followed carefully will produce excellent gears. I do not know whether it is used by others—it may be by many. One firm who make a great many gears must have some very similar system, as their gears that I have seen agree almost exactly with my own. The reference letters in the diagram have the following values:

$F = 2\frac{1}{2}\ P$,
$F_1 = F + f$,
$I = F_1 + 2\ f_1$,
$K = 1\frac{1}{2}\ L + \frac{1}{2}''$,
$K_1 = 1\frac{1}{2}\ L_1 + \frac{1}{2}$,
$K_2 = K_1 + 2''$
L = bore of pinion,
L_1 = bore of wheel,
$M = 0.6\ P \sqrt[3]{T}$,
$M_1 = 0.7\ M$,
$N = 0.35\ M \left(\text{or } \frac{M_1}{2}\right)$
$N_1 = 0.35\ M_1$ (or $0.7\ N$),
$O = \frac{1}{8}\ P$,
$S = \frac{1}{2}\ P$,
$S_1 = \frac{1}{2}\ P$,
T = number of teeth,
$U = \frac{1}{2}\ P$,
$U_1 = \frac{2}{3}\ P$.

The table gives valves for f, f_1, f_2 and H:

PITCH. Inches.....	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞	3
f.....	¼													⅜							
f_1.....	¼	½	5-16	⅜	7-16	7-16	½	9-16	⅝	⅝	11-16	¾	13-16	13-16	⅞	15-16	1	1	1 1-16	1⅛	1 3-16
f_2.....	⅛					3-16								¼							
H.....	2⅛	2 7-16	2⅞	3 5-16	3¾	4⅛	4 9-16	5	5 7-16	5¾	6 3-16	6⅝	7 1-16	7 7-16	8	8 7-16	8⅞	9 3-16	9⅝	10 1-16	10½

One of our patternmakers has a little kink for making the teeth of gears that seems to me to be worth showing, and Fig. 2 is a rough sketch of it. A is a block of either hard or soft wood with a notch cut out the length of the tooth B; $c\ c$ are thin spurs to prevent the tooth's twisting. The tooth-shaped part is made

a trifle tapering—for draft. A common rabbet plane is used for planing the teeth, care being taken not to have the cutter travel much more than the length of tooth.

When the teeth require a reverse curve for the flank a "round" as well as a rabbet plane will have to be used; in which case the stock for fillets cannot be left on, and fillets will need to be put in after the teeth are on the blank.

The parts *D D* should be made parallel and the taper be divided equally so that the teeth can be readily squared when fastening to rim. They are to be cut away after attaching to the rim so as to have a neat fillet.

The same rig is used for bevel gears. The thing to remember is to lay out the gear with teeth as long as the "former" is to be, and if each end of the former is properly laid out the gear tooth will be the correct shape.

There is a little detail in the construction of stuffing boxes that I would like the opinion of your readers on. In almost every case stuffing boxes are made, as in Fig. 3, with beveled top and bottom. If a short bevel is good, why would not a long one be better? The great majority of rod packings now used are square (or at least I suppose they are) and I cannot see the sense of putting a beveled edge to press on a flat packing—seems to me it would cause the packing to "flutter" in the vacant space.

Another question: If ¾-inch packing is right for a 3-inch rod, why isn't it all right for a 6-inch as well? Someone may say: "If ¾ inch is right for a 3-inch rod, why isn't it also right for a ¾-inch or 1-inch rod?" The answer to that is that there is reason in most (if not all) things, and it would be difficult to bend ¾-inch square packing around a ¾-inch rod. But I never could understand why some builders put, say ¾-inch on a 3-inch rod and 1 inch on a 4-inch—unless perhaps it's like keyseats, one-fourth the diameter. E. S. NEWTON.

[With the usual form of stuffing box, leakage is apt to take place around the outside of the packing, even though the gland be more than tight enough to stop leakage around the rod. The proper form for the end of the gland is shown in Fig. 4. The bottom of the box should be square.—ED.]

A Straight Casting from a Crooked Old Pattern.

Editor American Machinist:

The jobbing foundry that stands ready to mold and cast from any kind of an old thing as a pattern, however broken, warped or burnt it may be, has often very curious and intricate problems to tackle. To make the crooked straight and the rough places plain is a great drain upon the foundryman's inventive faculties.

A fire set of a very ornamental character, consisting of andirons, sides and back, complete, was brought to a jobbing foundry, and a number were wanted in duplicate, except the back. This being but ¼ inch thick had become from frequent heating bulged, warped and twisted as suggested in Fig. 1. The customer was very anxious that the new castings should be fac similes, except the back. "You can make that ⅜ inch thick and have it true and straight, of course."

The proprietor said: "We can take the large bulges and crooks out by breaking up that back; that is, dividing the curve up into a number of smaller crooks and imperfections. But the ornamentation will have to be sacrificed, and the only way that I see is to make the new backs either perfectly plain or to stamp some diamond marks upon it, or something of that kind."

Fig. 1

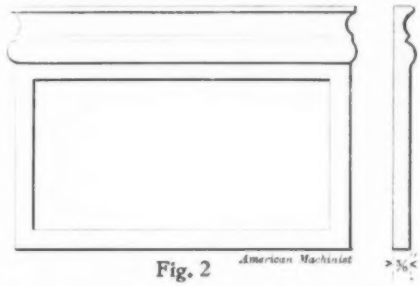


Fig. 2

A STRAIGHT CASTING FROM A CROOKED OLD PATTERN.

The customer was not prepared to have so ruthless a stroke given to the most artistic part of this much treasured heirloom, and with a "do the best you can with it, but whatever is done don't break that back, it belongs to my grandmother," away he went.

The job was turned over to the foundry foreman, to put his reputation at stake, as it were. After revolving and tumbling this matter over in his brain mill among other conundrums and sleeping on it, or trying to, he the next day started to develop ways and means to make a new fire-back that should be true and straight, reproducing every leaf, vine and flower of the bas-relief ornamentation and leaving the crooked back whole and unchanged.

A frame some 2 inches wide and 1 inch thick was made to fit closely around the outside of the fire-back, Fig. 1. This was arranged to be separated at two diagonally opposite corners. The back was cleaned and oiled and then laid upon a follow-board with the frame in position. A nowel was put on sufficiently deep to permit of at least 1 inch of sand above the back as the nowel lays. A charcoal dust bag was then shaken over the back and well-tempered clay of the consistency of dough was thoroughly kneeded on and into the fine lines of the ornamented surface to the end that the irregularities should be transferred, but in reverse, to the clay. The frame being compactly filled with the clay, the nowel was rammed up with nice tempered sand, a board was rubbed on and the whole was then turned over. The iron fire-back was removed, and there, upon a sand bed, rested a slab of pliable clay, with all of the iron fire-back's irregularities, in reverse, transferred to it. The next operation was to straighten the clay. With a molder's long lifter inserted under places too low between the clay slab and the bottom board, it was easily lifted and sand was tucked under it. Where a corner was too high sand was dug out and that portion was lowered to the proper line. It was but a few minutes before the clay slab was presenting an absolutely true surface, as true as level and straightedge could make it. The damp clay slab was set aside over night to harden. Next day a board the exact size of the clay slab and 1 inch thick was laid upon a suitable follow-board, the clay slab was laid upon the 1-inch board, and the nowel was put on, rammed up and turned over. The cope was rammed up with a 2-inch pouring sprew in the center, then removed and the 1-inch board drawn out. The edges of the sand mold were finished, the ornamental surface of the clay slab was finished with oil and plumbago dust. The cope was replaced and clamped and poured with very thin plaster of Paris, enough to cover the slab about ½ inch thick, so that it would insinuate itself into every fine line and figure. After waiting five minutes the remainder of the mold was poured with thicker plaster of Paris.

In a couple of hours, there was a plaster of Paris fire-back pattern perfectly straight, with every particular reproduced as the original was when new, except that it was 1 inch thick instead of ⅜ inch, as desired by the customer.

The plaster pattern, when dry, was shellacked and then rammed up with fine sand for a facing in a nowel that had strips ⅝ inch thick tacked upon the joint, boarded and turned over. The cope was rammed up and removed, the ⅝-inch strips were taken off and then a true straight joint was made all around the plaster pattern, leaving ⅜ inch of the pattern below the line of the joint, the thickness for the casting. After drawing the pattern and cutting the gates, the cope was put on and clamped and poured

with iron. When cooled it was dumped out and there was a straight and true fire-back, Fig. 2, with every feature as perfect as in the original cast-iron back before being distorted by repeated heatings, but with the increase of ⅛ inch in thickness.

L. C. JEWETT.

An Automobile Trial.

Editor American Machinist:

It has been my good fortune (?) in the last few months to take part in a number of auto-truck and carriage trials and a description of one of them, I think, would interest your readers. In the preliminary trials of the automobile it was speeded so high that it was almost impossible to run it steadily, and so the trials consisted mostly of holding on for dear life and wondering where you would land if you did go off, especially when the road was along the bank of the river with a row of telegraph poles on the opposite side. The question of speed was finally adjusted to a satisfactory basis, but the rest of the vehicle is still an unsolved problem.

The auto-carriage, which was run by a kerosene burner using a flash boiler and an ordinary 4½ horse-power engine, was a fair success, and I will try and give a history of one of the trial runs as near as I can remember it. The minor details of burned fingers, mud, and of being soaked with water and coal oil, I will omit, as they only interested me for the time being, and I prefer to forget them. I started alone one fine morning in October, intending to make a trial run of a few miles. I had a kit of tools in the carriage, and also a few extra parts that I always took along. I went up the main street toward the city and happened to meet the inventor of the carriage, who, by the way, is an English engineer of no ordinary ability, and a man whom you would like to meet. I took him in and we went up over what is known as the old King's Highway, it being the old stage road to New York. We passed through Fairfield, Southport and Westport, and kept on to Norwalk and then through to Portchester. Everything was running nicely; we were making eighteen miles an hour and the roads were good. My friend, the engineer, was by this time getting his sporting blood warmed up a bit, and he said if I would stay with him he would put her through to New York. Well, put her through we did, up hill and down, and through what the Englishman said were some of the worst roads he had seen. We stopped twice for water and refreshments and made New York at 6.30 P. M.

Now as we had neither lamps nor boiler inspector's or engineer's licence we were taking our chances, and, as I afterwards found, were liable to a fine of $500 if we had been called to account by the bobbys, as the Britisher called them. However, we reached the New York shop all right, making eighty miles in less than six hours actual running time. The next morning I went down to the shop and overhauled the carriage, packed the engine, tightened up the joints, filled the water and oil tanks, and put things in A1 shape generally, and at 3.30, with the assistant manager of the company for a companion (not the inventor) I started back. The manager was an expert operator, and the intention was to give the carriage a good trial. Not wanting to take any chances with the bobbys, we were towed up as far as 151st street, that being out of the reach of the ever-watchful police. The tows then left us, and I got up steam, taking about 11 minutes, and we started up that beautiful piece of road along the Hudson. Yonkers was reached, and about three miles more were covered, when, "zip," and a rush of steam told us that something was wrong. An examination showed that the main steam pipe had broken off short at the engine, and in going over the kit no screwdriver was to be found, it having been left at the factory in New York.

Well, the manager started back for Yonkers to get one, but with the aid of a broken jack-knife I took out the screws holding the seat, got out the broken pipe and put in one that I happened to have in the kit. (You see, I had been there before.) Well, the boss got back in about an hour, and I had steam up ready to start at 6.30, and we went through to Tarrytown, and just as we went down the long hill into the village I heard a sound that told me that the differential gear of the rear axle had given out, and on examination we found that the gears had been spread apart, caused by the body striking the axle in going over the washouts, and sprung the axle so that the pinion would not mesh properly. This was repaired shortly in an original manner; that is, I jammed in rags and waste into the gears until they were clogged so that the pinion would drive and not slip, and so we limped into town and put up for the night.

The next morning I hunted up a blacksmith's shop, got three ⅜-inch bolts, and did one of the most foolish things I ever remember doing. I bolted both of those gears together, making practically a solid gear of it. I knew that there would be a strain as we turned a corner, but I thought the bolts would stand it. At 9.30 we started again. Things went well until we struck a turn in a sandy road a little out of the town, and rip went those gears, cutting off the three bolts like a shear. Well, we pushed, pulled and coaxed the carriage into an orchard near by, the home of Miss Helen Gould, I was told, and the boss started for a telephone and called up the factory, and told them to get a new running gear and axle and send it down with a man to help put it up. This was about 10 o'clock A. M., and I lay under the trees and ate pears until the auto-carriage from the factory got there, and we put a new gearing on and got started at about 4.30 P. M.

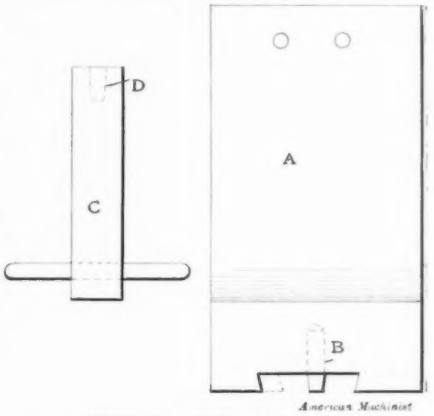
Things went smoothly for a while; we were making 18 miles easily, when snap, and a rush of steam told us that we were gone up again. It proved to be the steam gage connection. This was easy, as we had a second one in the kit, and it was put in at the expense of a blistered thumb in thirty-five minutes, and we started once more and made Portchester at 8 P. M. As the pump was giving a little trouble, it was thought best to stop for the night, and start again next morning. This we did, and at 7 A. M. we were on the road again. The night's rest did not seem to improve the pump any; it kept us going for a few miles, and then we had to resort to the hand pump. Things had been bad enough before, but now they were ten times worse. I sat on the dasher and pumped with one hand, and the general manager operated the carriage and pumped with the other hand, and I am free to say that he did his share on every stroke. We worked our passage until Stamford was reached, when we shoved the thing on a freight car and came home. Thus ended one of the most unsatisfactory trials I ever took part in, from the fact that while the boiler, engine and burner all worked O. K., still we had to walk back home.

J. L. LUCAS.

Getting a Dowel Pin Out.

Editor American Machinist:

As you requested all readers to give some of their experience on odd work, I will tell how we did something. The sketch will explain matters somewhat. *A* represents a drop-hammer head that came



GETTING A DOWEL PIN OUT.

with a new drop hammer. *B* is a dowel pin, which has a straight body 1 inch in diameter and 2 inches long in the head, and the part out of the head is 1 inch long and tapers to ⅞ inch. The body should have fitted loosely in the head, so as to be removed without trouble, but when we had to take it out we could not move it with a dog clamped on it, and our drop expert said the only thing to be done was to use a chisel and hammer on it, and

if it would come out it would be of no use then, being all chipped up.

Well, I thought I could save the pin, and took a 3-inch square piece of scrap (piped) steel *C*, drilled a ⅞-inch hole about 1½ inches deep and reamed it with our dowel-pin reamer (which was the same taper as the pin) in one end, as shown at *D*, until I could slip it on the pin *B* to within about ¼ inch of the head. Then I drilled a 1-inch hole through the bar at the other end (it being about 8 inches long) and drove a 1-inch rod, 16 inches long, halfway through (having no wrench to fit the bar). Then I heated the reamed end nice and red and slipped it on the pin *B* and shrunk it on. When it was cooled off one man tapped the bar lightly and the other twisted it until the pin was finally twisted out. We then heated the bar again, and the pin dropped out.

P. J.

Making Cylinder Pattern Barrels.

Editor American Machinist:

In issue No. 9 the gentleman with the migrating cognomen describes a method of building cylinder pattern barrels. The method is excellent, in economy of both time and material; but by this method a substantial pattern cannot be made where the difference between the diameter of the print and that of the pattern is less than 1½ inches, for the very obvious reason that sufficient thickness cannot be put into the staves of the pattern print.

I use the following method in this kind of patterns. Build up the barrel with little turning allowance, for pattern only; with heads set in from the ends of the staves 1 to 3 inches, as the size of the pattern may require. When turning the pattern, turn out the part of the inside of the barrel projecting beyond the heads. The diameter should be less than the print diameter. This is easily done on the tailstock end, and if the headstock end cannot be reached, turn the pattern end for end. The prints fit into this portion of the pattern.

Build the two prints in one piece, 2 to 6 inches longer than required for the print, with heads in each end only. When turning, turn this extra length slightly smaller than the prints, out of the middle of the length of the piece. This leaves shoulders to bear against the ends of the pattern when put together. The prints are cut apart after turning. Should the difference in diameter between the print and the pattern be greater than would permit turning out inside of the pattern barrel to receive the prints, build in pattern staves at the ends; or if the pattern has flanges at the end, put flanges on the prints and turn them there. Then turn flanges to fit the inside of the pattern ends and fasten through the flanges into the pattern ends. This makes a substantial pattern without surplus material.

J. L. Gard.

American and British Tools and Practices.

Editor American Machinist:

A point which, in America, seems to have almost escaped notice, in the recent settlement of the dispute between American machinists and their employers, is the recognition on the part of the employers of the limitation of the number of apprentices in machine shops. The abolition of such limitation was made a strong point of by the British Employers' Federation, and by it is considered a distinct gain. Have the States taken a retrograde step, or has Great Britain taken a step forward? The attempt, in the settlement, to define a good workman is very interesting. Possibly future conferences may provide definitions of recognizedly competent employers. The concerted action (to which attention was drawn in your editorial columns) on the part of the employers and workmen in the Chicago and district building trades, to give apprentices definite instruction in their respective crafts, is also very suggestive, especially having regard to the fact that in the Journal of the British Master Builders' Associations, British employers were bidden to be thankful that the restrictions imposed on them by the workmen's unions were mild, in comparison with those insisted upon by the very body of men who now appear to be working systematically, in conjunction with their employers, to raise the status of their craft. However, perhaps this anomaly is no greater than those to be found in other spheres of action. On the whole, regarding conditions of labor in America at present, the men appear, to the outside observer, to be modelling their efforts to improve their status on past British lines, and British employers seem to be taking leaves from the American employers' book in the matter of workshop organization. Perhaps in another twenty years or so there will be few marked distinctions between the two countries.

Mr. W. H. Booth's remarks *re* American tools voice opinions I have myself heard expressed. Personally, I think the very soft machinery steel often used for spindles, shafts, etc., though very good for purposes of rapid machining, is hardly in place on machine tools. It "seizes" in bearings on the slightest provocation, and is not so stiff torsionally as its diameter would appear to indicate; also, the soft cast iron almost universally used in American practice, might with advantage in many places be replaced by a harder mixing.

Another detail which in certain American practice sometimes irritates British customers is to see a tool, well thought out and finished generally, yet supplied with paltry malleable or steel cast handles and wrenches, with hexagonal or square holes scarcely cleaned out from the casting. In the case of a power hack-saw I have in use, the workman (not a "skilled," simply a "handy" man) was so disgusted with the rough handles supplied, that he, on his own initiative, replaced the offending articles with suitably finished forgings. It is always annoying to see such "economies." Another item not relished by many tool-users here, is the gilding of the lettering on machine tools. This is specially obnoxious when the lettering happens to be a bad sample of molding. This gilding is a method indulged in here by makers of the lower-priced class of domestic laundry machinery, it being intended to impress feminine purchasers of such articles. Dissatisfaction with certain American tools, produced during the hustle of the recent boom, is not altogether confined to European purchasers. I have at present in my possession several letters from a San Francisco tool-user, in which, after handling the names of several classic American tool-builders in a most irreverent fashion, he asks if "Whitworth still builds the best tools?" and hints at purchasing a Whitworth planer for the purpose of replaning the beds, etc., of other tools in his shop. I make no comment on his statements, except that he appears in search of the "best" tools, and does not object to pay any reasonable sum for them.* To me the moral of the editor's remarks *re* the selection of suitable English, American or other tools for workshop use, is, that it ought to be the definite work of someone in every shop of any pretensions, to study the shop's present and prospective requirements in the matter of tools; the same person to be armed with the requisite authority to obtain them, without demur, as soon as they are called for. Though, in old-time English shop phraseology, such an official might be termed a "non-producer," I believe the amount expended on his salary would yield at least as good a return as any other of his firm's outlay.

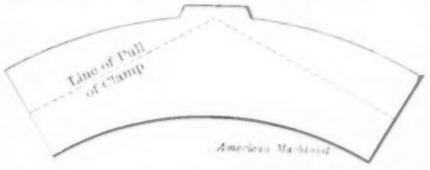
James Vose.

Manchester.

Clamping the Segments of Patterns.

Editor American Machinist:

Referring to your issue No. 7, I would suggest to Mr. Richardson that he cut only one trying piece, split it, and try the



CLAMPING THE SEGMENTS OF WHEEL PATTERNS.

two pieces. I would also suggest that he leave clamping projections on the middle of the segements, as per sketch, as this will clamp entire joint. I regard the use

* We have had several communications from an abusive crank in San Francisco and think Mr. Vose's letters are probably from the same source. His outpourings are not worth giving any attention to.—Ed.

of separate tongues as more practical and fully as good as any method; no special apparatus is then needed, the adjustments do not need to be so accurate in sawing grooves, and no extra length is required on the segement, all time-saving factors. I often use these same separate tongues in wheel-arms, the thicker the arm the more tongues, making joints to run to the center. This construction does not make it necessary to screw arms to hub, although it will add strength. Wheel hubs often need changing, so few screws are here desirable.

J. L. GARD.

Enlarging the Bottoms or Sides of Drilled Holes.

Editor American Machinist:

Mr. Oberlin Smith's description of a "non-wabbling" wabble drill, in issue No. 49 of last year, recalls an experience in the Pushfinger Shops of the H. P. & M. road. We don't know whether our experience antedated that of Mr. S. or not, but, at any rate, we had never heard of a patented device for this class of work; and, indeed, as we recall the circumstances, it seems that we did a little inventing ourselves. At all events, we brought out several tools, each very fair in its class. Our work was principally the preparing of surfaces to receive babbitt metal; that is, to drill a number of holes and undercut them so that the babbitt would not drop out (see Fig. 2). We started in with the "ancient and honorable wabble," but as the drill press had to come to a full stop at each insertion of the drill, and also required a specially prepared hole like Fig. 1, the tool to prepare this hole was expensive and short-lived, not to mention the liability of the wabble to lose a wing.

In casting about for an improved plan, we first decided to dispense with the flat-bottomed hole, and to use an ordinary drill forming the undercut with a tool like Fig. 3. This consisted of a bar, fitted to a No. 4 Morse socket, necked on the end to fit the drilled hole, and slotted to receive the cutter, which swings on pin *d*; *a*, the cutting point, is forced into the work by the rounded surface *b* coming in contact with the surface of the metal immediately surrounding the hole to be undercut; *w* is a weight or collar bearing down at *c* and causing the cutter to withdraw from the work when pressure is released at *b*. This tool cut a groove at a uniform distance from the surface, but it of course required a flat surface surrounding the hole. Our next effort produced Fig. 4, the cut in this case being produced by the round portion *b* coming in contact with a steel washer dropped into the bottom of the hole. The washer is shown at *B* with a small hole in which we insert a wire to pick it up and drop into the next hole. In this tool we used a spring to release the cutter. The bar was slotted just far enough to prevent the cutter swinging past the center, and also to leave solid stock immediately opposite the cutting point. The bar, made of tool steel and hardened on the end, formed a most durable rapid-working tool, forming a groove at a uniform distance from the bottom of the hole.

We afterwards made a tool, as in Fig. 5, capable of cutting a groove at any depth to which the tool may be inserted, by simply raising the lever handle *H*. This forces down a rod inside the bar, thus forcing out cutters at points *a a*. When the handle is released, the weight of it causes it to drop, raising the plunger and collapsing the cutters into the bar. Motion is imparted to the plunger by a key passing through the plunger and through an elongated slot in the bar into a ring on the outside of the bar. This ring has a groove, running in which is a split ring, drilled on opposite sides to receive points of screws in the fork of the lever. The fulcrum for the lever is a pin in one of the separators *s s* of a cage formed by the two separators riveted into opposite sides of two rings *r r*. These rings work freely in annular grooves of collars *c c*, thus enabling the handle to remain stationary while the bar is revolving. A short rod projecting downward from the drill press, similar to that used to hold a tapping fixture, insures the handle remaining stationary. This tool can also be used for dovetailing in wood or metal.

ISAAC MORGAN.

Bavington, Pa.

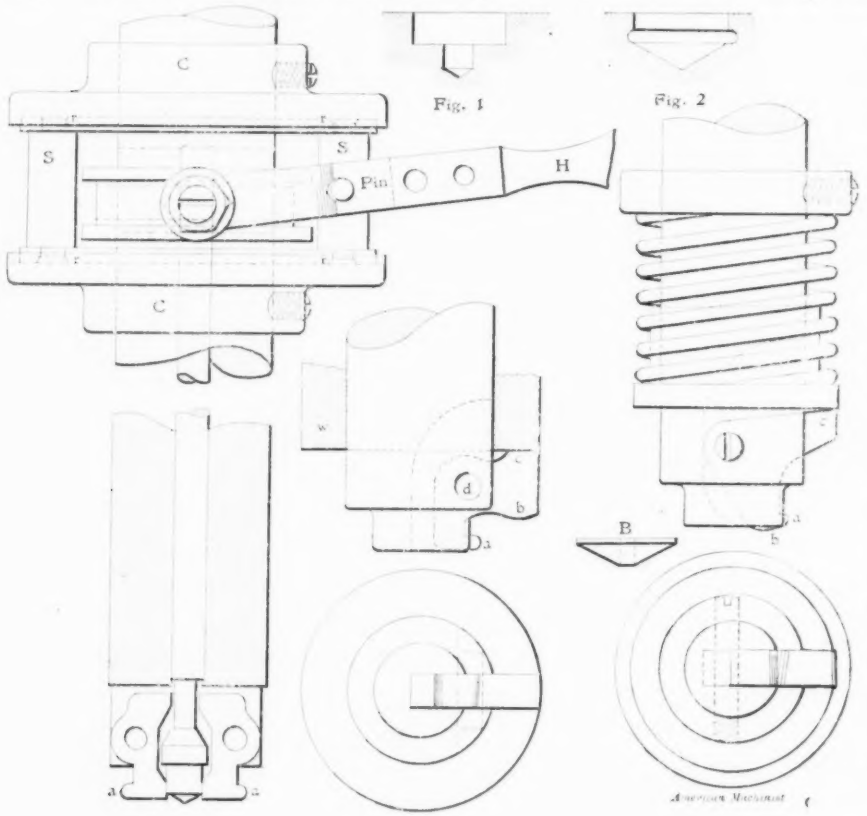


Fig. 5 Fig. 3 Fig. 4

TOOLS FOR GROOVING OR ENLARGING THE BOTTOMS OR SIDES OF DRILLED HOLES.

Charging Workmen for Lost Tool-Room Checks.

One of our readers, who is a toolroom foreman, recently wrote us stating that in the shop where he works the check system in giving out tools is used. He complains that the men are continually losing their checks, and he wants to know whether or not the employer has the legal right to charge these men a certain sum for the checks they use, agreeing to buy back the checks upon the termination of their relations, or whether or not the employer has the right to hold a portion of the wages of the men as security for the return of the checks.

The employer undoubtedly has the right to adopt either of these methods to prevent the loss of checks by the men. He should, however, first inform the men of the plan and make it a condition of their employment, so that they may either accept employment upon these terms or reject it. If they object to these conditions, their remedy is to decline to work for the firm.

The employer is free to impose whatever restrictions, within reason, upon his employees he deems best for the protection of his interests, and the employee, on the other hand, may terminate his relations with his employer when these restrictions become burdensome or whenever he cares to do so. An employer, however, often exceeds his rights when he seeks to impose restrictions without notice. For instance, it is a common practice, if a domestic servant or other employee accidentally

breaks an article belonging to the employer, for the employer to deduct what he deems to be the value of the article from the wages when due. If when the agreement of employment was entered into and the wages were fixed, the parties did not agree to this practice, allowing the employer to deduct what he considers the value of the article, the employer, strictly speaking, would have no right to do so.

If the contrary were true, every employer could act as judge and jury in his own cause, to determine whether the employee had been negligent and careless in the performance of his duty, and had thus caused certain damage to the employer. After the employer had decided his own case in his own favor, he could further usurp the function of court and jury and assess the damages. Such a state of affairs would be manifestly unfair to the employee.

Where the employer makes deductions from the wages of the employee, independent of any agreement between the parties, and the employee believes himself wronged thereby, he may sue his employer to recover the balance of his wages.

Either of the plans suggested by the toolroom foreman would doubtless be considered in law a not unreasonable means of protecting the employer's interests. To be enforceable, however, we think that there must previously be either a formal agreement to accept it, or at least such an acquiescence in the employment with knowledge of the condition that it will amount to a tacit agreement.

An English Mechanic in America.*

About five years ago I was working in Lancashire at my father's works, and, being in the machine business, could not but help continually learning of the Americans' ability to build and duplicate machines that were in many ways superior to those built in Europe. It occurred to me, therefore, to come over here to the United States to obtain a position in some good machine shop, and to have a practical understanding of how they run things here. I have worked over here some time now in the toolrooms of various machine shops, and have noticed many differences, and one in particular—the eagerness to suggest ways and means over here. I also found quite a little to learn in the standardization and specializing of machines and parts.

Almost every nationality is represented in the shops here—from the New England Yankee to the Russian Jews and Italians. Harmony seems to be among them pretty well, and right here in the mixing of nationalities arises a benefit. Because out of these men's conglomerated ideas they must hit a good one, once in a while any way. And they have done so, as has been seen. Although the men are not "sassy," or as "independent as a hog on ice," they have sufficient confidence in themselves to "catch on" and work with a vim.

In my different positions I was in contact most of the time with a class of men who have done more than any other to give an impetus to American manufacturers—that is, I think, the toolmaker of America. If England could bodily "lift" these men from the States, every toolmaker that amounted to anything, and put them to work in her own shops, they would have one of the hardest propositions that any competitor could wish for. Having these men would not, of course, be the whole thing, but it would go a long way.

Naturally arises the question, can an Englishman become as expert and scheme like the American toolmaker? Yes, he can and does do, right along. I have worked alongside Englishmen who could scheme and make tools in every way as good as the American born. Maybe he could not scheme to the same extent when he was in England, because no one asked him to. But when he comes here, they not only ask him, but they do something more subsantial still—they pay him for it.

I have asked many British-American machinists and toolmakers whether they would care to work in Great Britain again, and though these men were patriotic to England to the core, have in almost every case made some such expression as this:

"Not on your life would I care to go back there."

"Why, how is that?" I would say.

"Well, I tell you," they say. "If I were a wealthy man this country couldn't hold me a minute. I would live in England then, where art, literature, science and honorable men would be my acquaintances. But I am not a wealthy man; I work by the week, and receive pay according to my ability; therefore I would much sooner live here. If my opportunities were as good in England, and my pay equal in purchasing power to what I receive here, then I would much rather live in England."

I know by my own experiences that a state of things exists in England that ought not to exist. If a workman makes a suggestion in England, ninety-nine cases out of a hundred he is ignored entirely. I myself have been among workmen in England, and in conversation with them have heard them say that they could see where improvements could be made to expedite the production of some particular part of a machine. On asking why they did not mention the matter to the foreman or manager, they say:

"If I mentioned it to the foreman he would pretty well snub the idea, or give me no credit for it at all. And if I told the manager, the foreman would think I was after his job, and at the first opportunity discharge me; so I do not see any benefit for me."

Consequently, one of the most vital necessities that any nation, concern or individual should have for success (originality) is not encouraged, but kept down. That is why America has made such rapid strides in commerce; once she got started the American manufacturers have been able, and are able now, to use higher-priced labor, to be a longer distance away from foreign, especially European markets, and still underbid their competitors. They may not have originated automatic machinery, jigs, gages, the standardization of parts, etc., but they are able to see at once the great advantage to be got from their usage, and have the foresight and originality to apply labor-saving principles to any fresh department of manufactures they may take up.

The terms "cute and cunning Yankee" are wrong; he is not cute and cunning, but, to my mind, has an overpowering lust for the dollar, and common sense. When an American machinist or workman has an idea, the patent office is in easy access to his salary; the people are invariably glad to use some new idea, provided there is any little benefit in so doing, and not, as in England, pleased to find so many objections to an invention or scheme. If an idea will only save cents, it has the attention of most every man in its particular department in the States. In England, if the self-same idea would be introduced, people to whom it was shown would say: "Well, it may save a copper or two, but it is not worth while bothering with." And so it is in many departments of English manufactures. Detail is the keynote; if an American can see where a small saving may occur, a small improvement made in their manufactures, a better engraving or a more attractive way of putting their products before probable customers, any little scheme at all that will help, no matter whether it comes from a laborer, manager or president, or whether it is an English, German, French or Russian idea, it receives attention.

I had an idea for a certain labor-saving device. I made a sketch and showed it to the manager of the firm I was with here in the United States of America, explained it to him, and he was interested and saw its feasibility, told me to make a model in his toolroom, and see how it came out. I did as he said, it coming out satisfactorily. After which I made application for a patent, which, if granted to me, will benefit me considerably. If the same proposition had been shown to a manager or foreman in England, it would very probably have been pooh-poohed.

In England great individuals have been born with very fertile brains, men whose names will never die; but it is not policy to rely on a few men, but to encourage and not put down originality; let every man have his ideas considered, and make it worth while for the men to scheme

*From "Engineering," London, February 22, 1901.

and expedite things, and they will then maybe leave some of their narrow-mindedness and faith in trades unions as to output per man, etc. I know plenty of English and Scotch mechanics in this country that would much rather live in Great Britain if they had a "show" of getting on the same as they have here; they would rather live under a government of clean politics, that gives law, justice and a proper interest to its citizens, such as England provides.

In conclusion, any firm, corporation, or nation which can produce per man a greater output than its competitors of articles of equal value will have most certainly the more prosperous people. Therefore, English manufacturers, take on with new schemes or suggestions, and expedite your manufacturing; maintain, and, if possible, better your products, and cheapen cost. Let men have your attention so as to get the most out of them, put in good labor-saving tools, use templates, gages, jigs; have convenient and properly built tools, have a systematic toolroom, and specialize. If an idea comes from a laborer, machinist or president, if it is an American, German or French proposition, provided it has merit, do not wait, but sail right in and use it. Be always on the look-out for new schemes, and ideas will evolve themselves. Advertise well and "pithy," use good illustrations and bring out the salient points of the machines or articles you produce, be it trivial or momentous. English manufacturers have the advantage of a fine geographical position, have a good and well-established reputation and cannot be approached yet in some of their industries. Therefore, do not get scared because you do not get orders for every quotation you submit. English manufacturers with the right kind of thought will always have a good living for themselves and the people dependent upon them. H. HARRAP.

Legal Notes.

BY WM. MARSTON SEABURY, LL. B.

ALLEGED DANGEROUS GROUPING OF POWDER BUILDINGS.

An interesting case was recently decided by the Appellate Division of the New York Supreme Court, Second Department, in which a judgment of $6,000, obtained against the Laflin & Rand Powder Company in the trial court, was reversed.

John Craig was employed as engineer in the company's smokeless powder plant at Pompton, N. J. He had general supervision of the machinery. The most dangerous part of the work of making the powder was performed in the mixing house. About 5 feet from the mixing house was an assembly room; about 80 feet from the assembly room was a well, and at least 100 feet farther was a guncotton dry-house. All of these receptacles contained high explosives.

On a certain day, a moment or two after starting the machinery in the mixing house, an explosion occurred, presumably in the mixing house, followed by another explosion, probably caused by the first detonation. Craig was standing opposite the assembly room farthest from the mixing house and was killed, probably by being struck with débris.

Craig's widow brought suit against the company to recover damages for his death, and alleged that the explosion was the result of the company's negligence in grouping the buildings and out-houses containing the explosives, and in storing explosives so near the mixing house that an explosion in that house would be likely to extend to the others.

To support the theory that her husband was killed by débris from the assembly house or wall near it, and not from the mixing house where the first explosion occurred, it was necessary for her to show that her husband's death had been caused by the second explosion; for if he was killed by débris from the mixing house, then the charge of negligence in the improper grouping of the buildings and storing of the explosives would have had nothing to do with the case. In reversing the judgment of the trial court, Mr. Justice Hirschberg said, "Assuming that the defendant would be liable to an employee for injuries which could be proven to have been occasioned solely by the second explosion, but of course without deciding it, I find no sufficient proof that the decedent's death was so occasioned." (55 App. Div. 49.)

The French Machinery Trade in 1900.

The French Government has just published advance statistics on the foreign trade of the country during the last year. The following figures, which are taken from this official document, will be of interest.

The imports and exports of machinery into and from France during the last eight years were as follows:

	Imports Francs*	Exports Francs
1893.....	46,725,000	30,149,000
1894.....	57,008,000	34,976,000
1895.....	58,593,000	36,964,000
1896.....	62,179,000	46,148,000
1897.....	67,633,000	43,772,000
1898.....	77,655,000	55,035,000
1899.....	103,633,000	61,512,000
1900.....	141,478,000	61,402,000

It will be seen from these figures that the imports of machinery into France rose from 46,725,000 francs in 1893 to 141,478,000 francs in 1900, an increase of more than 300 per cent. It may be admitted that the large increase in the importation of machinery during the last two years, 1899 and 1900, is due to some extent to the increased demand created by the recent Exposition, but according to appearances the imports of foreign-made machinery will continue to increase.

*One franc equals 19.3 cents.

Analyzing the import figures of the last two years, we find that they were composed of the following principal items:

	1899 Francs	1900 Francs
Stationary and marine engines.....	6,053,004	8,138,680
Locomobiles	1,374,450	974,160
Locomotive engines..	1,737,636	7,858,000
Hydraulic power and ventilating mach...	1,404,429	2,081,900
Locomotive tenders..	128,321	771,460
Textile machinery...	12,600,000	20,126,000
Paper machinery....	466,460	949,400
Printing machinery..	477,348	911,115
Agricultural mach....	19,345,945	20,345,000
Sewing machinery...	11,207,890	12,612,340
Dynamo elec. mach...	6,018,473	11,963,250
Machine tools.....	10,293,912	14,326,585
Power trans. mach..	10,707,680	17,021,900
Boilers.....	1,678,140	1,055,800
Sugar and distilling machinery	45,355	54,300
Refrigerating mach...	2,381,885	6,887,900

It will be seen from these figures that an increase took place in almost every line of the machinery trade. Especially large increases are shown in the importation of textile machinery; this is the more astonishing, as the general conditions in the French textile industries were anything but satisfactory; but in spite of the unsatisfactory trade conditions prevailing in the great textile centers, Lyons, Roubaix, St. Etienne and elsewhere, the imports of spinning and weaving machinery into these districts increased.

The imports of agricultural machinery into France have also been steadily on the increase. In 1898 they amounted in value only to 12,618,150 francs, as against 20,345,000 francs in 1900. But in spite of this increase, modern machines and implements are still greatly needed throughout the agricultural districts of the country. In many départements the farmers use as yet the most ordinary and antiquated implements, and in certain districts in Southern France plows can be seen on quite large estates which the smallest farmer in this country would not deign to till his land with. Likewise increased are the imports of machine tools, they having risen from 10,293,912 francs in 1899 to 14,326,585 francs in 1890. The imports of power transmission machinery show an increase of over 6,000,000 francs in 1900 over the previous year. A considerable demand exists for refrigerating machinery, especially in the large cities of Central and Southern France. But even in the northern parts of the country improvements in this respect ought to be welcome.

The introduction of electricity on a larger scale has also created a heavy demand for dynamo machinery. It will be seen that the imports in 1900 exceeded those of 1899 by about 5,900,000 francs. Many new electric plants are now either under way of construction or contemplated, and the prospects for this class of machinery are very favorable.

A large increase also took place in the importation of locomotive steam en-

gines—from 1,737,636 francs in 1899 to 7,858,000 francs in 1900.

As to the principal countries of origin, the following may be said: Great Britain takes the lead. Her machinery exports to France rose from 30,058,555 francs in 1898 to 31,866,866 francs in 1899, and to 38,791,000 francs in 1900. The second place is now held by the United States, with 36,605,500 francs in 1900, as compared with 29,866,346 francs in 1899, and 16,151,992 francs in 1898. No other country shows such a large increase. Germany supplied 35,605,000 francs' worth in 1900, as against 23,814,972 francs in 1899, and 18,978,425 francs in 1898. Belgium's share amounted to 16,974,000 francs in 1900, as compared with 11,831,000 francs in 1899, and 7,385,283 francs in 1898. Switzerland comes in the fifth place, with 8,750,000 francs in 1900, and 4,801,018 francs in 1899. The figures for 1898 are not given. Then comes Austria-Hungary, with the trifling sum of 1,953,000 in 1900.

Besides the above-named machinery imports, France imported small tools, with and without handles, to the amount of 4,085,430 francs in 1900, as against 3,826,938 francs in 1899 and 3,339,642 francs in 1898.

The exports of French made machinery went in the main to the following countries:

	1898 Francs	1899 Francs	1900 Francs
Belgium	14,158,886	15,428,410	15,020,000
Spain	2,574,443	5,364,154	7,510,000
Germany	6,070,338	6,953,805	6,457,338
Great Britain	4,070,090	4,090,388	3,717,000
Switzerland	3,987,651	3,878,177	2,785,000
Russia	1,370,689	2,282,177	2,143,000
Italy	1,708,602	2,470,167	2,073,000
Brazil	1,052,299	828,993	862,000
Argentina	867,945	767,321	816,000
Turkey	578,446	626,182	653,000
Austria-Hungary	(Not stated)	20,300	305,000

The only country to which the exports of French made machinery increased to any considerable extent was Spain. This may partly be attributed to the proximity of the two countries and partly to the fact that a large amount of French capital is invested in Spanish industries.* That such large investments in a foreign country are, however, not always a reason for the supply of machinery required by the industries created by foreign capital is best demonstrated in the case of Russia, where immense sums of French capital are invested. In 1899 the Russian Empire imported machinery to the enormous value of about $58,000,000, of which the very modest amount of $450,000, or less than 1 per cent., was of French origin.

H. L. G.

*The increase is probably due to Spain's partial recovery after her wars, and especially to the investment in her home industries of native capital withdrawn from Cuba, or which would otherwise have found an outlet there.—Ed.

Technical Publications.

"Eingriffverhaeltnisse der Schneckengetriebe mit Evolventen- und Cykloidenverzahnung und ihr Einfluss auf die Lebensdauer der Triebwerke." By Ad. Ernst, Professor des Maschineningenieurwesens a. d. Koenigl. Technischen Hochschule Stuttgart. 92 pages, with 77 figures. Berlin: Julius Springer. Price, 4 marks.

Those against whom German books are not sealed by the language may here peruse a comparatively brief treatise on the proportions of worm gearing with involute and epicycloidal teeth and their influence upon durability. It is a graphic investigation for practical purposes and technical schools, and is from a prominent Berlin press.

"Hendricks' Architectural, Engineering and Mechanical Directory for the United States" for the year 1901. 1,140 pages. New York: Samuel E. Hendricks Company, 61 Beekman street. Price, $5.

This is the latest edition of a directory which has been published annually for the last ten years. It is devoted to the architectural, engineering, contracting, mechanical, electrical, railroad, mining and kindred industries of the country, with lists of the manufacturers and dealers in materials and products, machinery and apparatus. Over 350,000 names, addresses and business classifications are comprised. We keep one of these volumes conveniently at hand in the "American Machinist" office, and are pleased to testify to the assistance frequently derived from it.

"Electric Lighting. Vol. II. Distributing System and Lamps." By F. B. Crocker. 505 6x9-inch pages, with 391 illustrations. D. Van Nostrand Company, New York. Price, $3.

This second volume of Professor Crocker's treatise is a fit companion to Volume I, which treats of the generating plant. The two volumes form probably the most satisfactory treatise on the present practice in electric lighting that exists. It is very complete and practical in the best sense, and while strictly scientific and representative of the best class of technical literature, it is mathematical to a very small degree only. The line of division between the fields covered by the two volumes is very sharply drawn, so that each, in its field, is complete in itself, and a purchaser need not buy the first volume in order to read the second intelligently. The work is in every way creditable to both author and publisher.

"American Engineering Competition." A series of articles resulting from an investigation made by "The Times," of London. New York: Harper & Brothers. 139 5½x8½-inch pages, cloth. Price, $1.00.

Some time ago we gave expression of our opinion concerning the series of articles which appeared in "The Times," of London, under the above title. These articles have now been put into book form, and we think most of those who are at all interested in the great industrial and commercial questions that have arisen from our going abroad with our steel, our machinery and other manufactures and products, will feel well repaid for reading this book, which contains the record made by a trained, open-minded and technically well-informed observer, familiar with manufacturing operations in Europe, and competent to judge of points of difference between European and our own practice. As we have before remarked, in effect, the author was under the necessity of describing our best practice and establishments, in order to show his compatriots what kind of competition they have to meet. This makes his book seem to give America credit for having a more perfect and a more smooth working industrial organization, as a whole, than we really possess. This, however, results, not from the author's want of knowledge of our industries, but from the purpose he had in view in writing the articles for "The Times"—a purpose which, to judge from the criticism and discussion that have been called out by the articles, both here and in England, has been thoroughly accomplished.

Rapid Fire Guns, Ancient and Modern—Erratum.

In the fifth line of the second column, page 241, issue No. 10, for *cored* read *coned*.

In answer to inquiries as to where the French sand referred to in an article by Mr. John G. Niederer can be obtained, Mr. Niederer informs us that it can be purchased from Whitehead Bros. Company, 537 West Twenty-seventh street, New York city.

Blohm & Voss, of Hamburg, Germany, who are the builders of the cruising yacht "Prinzessin Victoria-Luise," which we gave some description of in our issue No. 5, 1901, send us blueprint plans of the vessel and a photograph taken January 4, the date on which the German Emperor was on board of the vessel at the port of Hamburg.

Inquiries for Machinery.

(146) Wanted names and addresses of manufacturers of riveting machines for handling rivets 5-16 inch diameter and under.

(147) Address of the American firm who make the "Acme" automobile engine.

(148) Address of the maker of the Fox radial steam hammer, arranged like a radial drill.

Personal.

Chas. A. Francis has resigned his position with the Diamond Meter Company as foreman of the direct-meter department and will enter the model department of the Pratt & Whitney Company, of Hartford, Conn.

Chas. W. Weller, Edw. J. Kiley, Edw. F. Tiel, O. L. Whiteman and Frederick Lyons have resigned from their positions with the Kennedy Valve Manufacturing Company, and the four gentlemen first name are respectively president, vice-president, secretary and treasurer of a new company they have organized at Coxsackie, N. Y., to be known as the American Valve Company.

We have referred to the change that has taken place in the business of the Kempsmith Company, of Milwaukee, and learn that this change has been made necessary by the fact that Frank Kempsmith is now nearly blind. He first lost the sight of one eye entirely, and it had to be removed. The remaining eye is so weak as to be of no service to him in the conduct of business, and it is believed by Mr. Kempsmith and his friends as well, that his days of active work are over, although he is at the present time only fifty-three years old. At about the same time that his eye was removed, his boy was killed by a railroad train, so that he seems to have had more than his share of troubles. On the other hand, he retires with an excellent record as a mechanic and a manufacturer. He worked at one time at Brown & Sharpe's, and was for some time superintendent of the shops of Warner & Swasey at Cleveland. Afterwards he went into business in Springfield, Ohio, where he had formerly been employed as a toolmaker. He removed to Milwaukee about thirteen years ago, and had built there an excellent shop, exceptionally well equipped and arranged for the production of milling machines, which were his specialty, although he occasionally did some other work. While by no means rich, in the modern meaning of the term, Mr. Kempsmith, we are glad to say, has enough of this world's goods to make him comfortable, and he speaks very highly of those who succeed him in the conduct of the business he has built up. He believes they "will be heard from in a very creditable way." Mr. Kempsmith's success has been founded chiefly, perhaps, upon his superlative skill as a mechanic. The superintendent of one of our most prominent tool-building concerns once remarked to the writer: "I consider Frank Kempsmith the best mechanic that ever worked in our place. He had the skill and the nerve to make a job exquisitely fine when it was required to be so, and at the same time he had the good judgment to stop work on a job as soon as it was good enough for the purpose it was to serve."

Obituary.

John M. Bogle, master mechanic of the works of the Gorham Manufacturing Company, Providence, R. I., died in that city March 7, fifty-two years old. Mr. Bogle was educated in the public schools of Providence, learned the machinist trade and began work for the Gorham Manufacturing Company as a toolmaker in 1869. He was rapidly advanced, and had been master mechanic for a quarter of a century. He devised the drop-hammers and many special machines used by the company and planned and supervised the erection of the present magnificent factory. In our issue of February 14, 1895, is an article which describes the foundations of the drop-hammers. These are of the most solid description, and while the practice was shown to differ from that of other authorities in the same line, the results obtained are not surpassed anywhere. Mr. Bogle's genius extended to the supervision and improvement of the details of construction and operation all through the works. Mr. Bogle died suddenly of heart disease while adjusting the mechanism of an automobile on the road.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 28.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

For circular of new book on steam engineering, address W. H. Wakeman, New Haven, Ct.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

For Sale—One 2 H.-P. gas engine, $65 ; one 4 H.-P. gas engine, $85. Box 1171, Springfield, Mass.

Wanted—20 or 24-inch engine lathe, 18 or 20-inch power drill press. A. V. Evans, 106 Beekman st., New York.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For positions in charge, or competent men for such positions, address James Brady, 220 Broadway, New York City.

We will pay $5 for an index to the "American Machinist" for year 1895. Address R. K. Le Blond Machine Tool Co., Cincinnati, Ohio.

Practical man desires to represent manufacturers of steam specialties or machinery ; New York city and vicinity. Box 382, Am. M.

Auto Engines (5 H.-P., gasoline or steam) —Full set shop drawings on receipt of $1. A. McHarg, C. E., 113 E. 19th st., N. Y. City.

For Sale—Foot-power screw cutting 8x36 lathe, fine link valve motion model, bench vise and other tools, cheap. Benj. Crossley, Schuylkill Haven, Pa.

Patternmaker, A1, well-equipped shop at home, will do light or medium pattern work of the better class at reasonable rates. Box 362, American Machinist.

Wanted—A partner or a manufacturer to put on the market a tachometer, also a safety-pin, patents on which are pending. Address Box 397, American Machinist.

Wanted—A good business man with $8,000, to take interest in gas-engine works ; business already established ; give full particulars. Flickinger Iron Works, Cochranton, Pa.

Wanted to Manufacture.—A machine shop with facilities for medium and heavy work desires to secure some special machine to manufacture. Address Box 383, Amer. Mach.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman wants position. Box 372, Am. M.

Toolmaker, machinist, seeks position. Box 371, American Machinist.

Toolmaker seeks position as foreman. Box 373, American Machinist.

First-class mechanical draftsman, graduated, wants position. Box 386, Amer. Mach.

Mechanical draftsman wishes position ; go anywhere. Box 399, American Machinist.

Experienced toolmaker, also a good draftsman, employed on fine work, desires change. Address Box 398, American Machinist.

Technical graduate, 12 years in charge of drawing-room, would change for position requiring ingenuity and ability. Box 352, South Norwalk, Conn.

Wanted—By foundry foreman, foremanship of foundry making engine castings or general jobbing, heavy or light. Address Box 178, American Machinist.

Practical machinist wants position as foreman of shop or toolroom ; wages to commence no object ; has position ; wishes change. Box 388, American Machinist.

Mechanic, 20 years' experience handling men and machinery, wants responsible position ; preferably with general contractor ; machine tools or steam engines. Address Box 387, American Machinist.

A thorough, up-to-date mechanic, of practical inventive ability, long experience, good die and tool-maker, used to take charge, wants suitable position to make full use of his ability. Box 402, American Machinist.

Inventive, ingenious toolmaker, electrician, mechanic, fine executive ability, modern system, 12 years' experience, wants position ; manufacturing concern ; general foreman or superintendent. Box 384, Amer. Machinist.

Position as superintendent, by experienced mechanic : can produce good work, not excuses ; can successfully figure on work or contracts ; machine tool or light automatic machinery my specialty ; East preferred. For references address Box 376, Amer. Mach.

Young man, energetic, capable and reliable, desires position in any capacity requiring above qualifications ; technical graduate ; experienced draftsman ; nearly 4 years on steam power plants and elevator and conveyor machinery. Box 364, American Machinist.

Machine-shop foreman desires change ; experienced on high-grade heavy and small interchangeable machinery and electrical apparatus ; toolmaker and designer ; can furnish A1 references from past and present employers as foreman and workman. Box 403, American Machinist.

Mechanical engineer, extensive shop and business experience, technical education, member A. S. M. E., seeks responsible position ; specialties, high-grade engines of all types and large high-duty drainage and irrigation machinery ; controls valuable patents. Box 374, American Machinist.